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DEPARTMENT BULLETIN No. 1473

Washington, D. C. ▼ April, 1927

COTTON-SPACING EXPERIMENTS AT GREENVILLE, TEXAS

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U. S. Department of A

By

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By Homer C. McNamara, *Assistant Agronomist, Office of Cotton, Rubber, and Other Tropical Plants, Bureau of Plant Industry*

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INTRODUCTION

Cotton-spacing experiments were conducted at the United States Cotton-Breeding Field Station at Greenville, Tex., from 1921 to 1925, inclusive. These experiments showed a definite tendency toward greater yields from plants spaced less than 12 inches apart in the row, and the highest yields were obtained from rows that were not thinned or chopped but left in the original stands with the plants averaging 2 to 4 inches apart. Within certain limits there seems to be a general positive correlation between the number of plants per acre and yield. Although there is undoubtedly a limit to the number of plants that can grow in a row and produce more cotton than plants spaced 12 inches apart, this limit has not been determined for Greenville conditions, even with heavier rates of planting than are usually employed.

The experiments included a wide range of different stands and spacings, planted on the well-known black land or Houston clay of Texas. In connection with these experiments at the Greenville station, two experiments were conducted on a farm near Campbell, in the same county, on a fine sandy loam soil characteristic of the small stream bottoms of eastern Texas.

In the 1925 tests cotton was planted at the rate of 45 pounds of seed per acre and left unthinned, which gave an average distance of slightly more than 2 inches between plants. This unusually close spacing produced more cotton than wider spacings, even though the season was very dry.

The results of 18 separate tests during this 5-year period show that yields are more likely to be reduced than increased by chopping.

GENERAL CONDITIONS AT GREENVILLE

The United States Cotton-Breeding Field Station at Greenville, Tex., is an outgrowth of work conducted since 1904 in Texas and adjacent States by the Office of Cotton, Rubber, and Other Tropical Plants, of the Bureau of Plant Industry, United States Department of Agriculture. The station was established in 1918 through a cooperative agreement between the department and the Greenville Chamber of Commerce. It consists of a 60-acre tract of typical black land about 4 miles southwest of Greenville.

Greenville is situated in Hunt County, in northeastern Texas, about 52 miles northeast of Dallas and 60 miles southeast of Denison. It is on the line of division between the well-known black-land prairie belt and the interior coastal-plains country of the eastern part of the State. The black-land belt forms the principal cotton-growing section of the State, while the interior coastal-plains area includes a large part of the sandy soils characteristic of eastern Texas. The black-land or black "waxy" soil is technically described as Houston clay. It is a very heavy, fertile clay, highly retentive of moisture, which enables plants to remain in a growing condition over long periods of dry weather.

The 10-year average annual precipitation is 39.09 inches. The growing season is approximately 235 days, with the first killing frost, over a 10-year average, on November 11, and the last in the spring on March 21. Though occasional wide departures from these means may be expected, the greatest climatic variation is with respect to rainfall.

EXPERIMENTAL METHODS

The experimental lots of cotton were planted, thinned, and picked, so as to provide several side-by-side comparisons of the different spacings. These comparisons were made on the basis of alternating 4-row blocks. Where a greater number of comparisons are provided for, an opportunity is given to study in greater detail the consistency of behavior, and the effect of soil variation is lessened. Some of the first experiments discussed do not provide an adequate number of comparisons to be handled satisfactorily on a statistical basis, but they are indicative in conjunction with other experiments.

The Lone Star variety, of the Texas big-boll storm-proof type of cotton, was planted in all of these experiments, and the rows were usually spaced 40 inches apart. With few exceptions, thinning was done when the plants were about 6 inches high and were bearing from five to seven true leaves. Unless otherwise indicated, thinning was done by hand, the plants being left at measured distances, as near as the stand would permit.

Flower counts were made daily on the two inside rows of each block, from the appearance of the first flower until the peak of flowering had been passed.

At picking time the experiments were divided into sections by stretching strings across the rows at accurately measured distances, which assured weights from rows of the same length. In some cases the length of the sections was determined by the size of the plants, with a view to including only plants of comparable size and development. Large productive plants at the ends of the rows were eliminated. The yield of seed cotton from each section of each row was recorded separately. This system of subdividing the experiments gave an increased number of row yields and 4-row block comparisons and afforded a basis for comparing statistically the yields from the different spacings. Usually only two, and never more than three, spacings were compared in any one experiment.

Before the cotton was picked, boll samples were systematically taken from each block of each spacing for laboratory examination. From these samples data relative to boll size, seed weight, percentage of lint, and length of lint were obtained in order to study the relation of spacing to these characters.

After picking, the plants were counted, and these counts are recorded for each row section in the tables of yield.

Since conclusions based upon the total yield of each spacing are likely to be misleading, the interpretation of yields is based upon consistency of behavior in the side-by-side comparisons. Though the data could be presented and analyzed in various ways, it is probable that nothing of value would be added to the conclusions by doing so, and this feature has been intentionally avoided on account of the number of experiments reported. Where there are enough comparisons, the figures are handled on the basis of differences of the sum of the yields of the two inside rows of adjoining blocks, which is a simple, reliable method of showing differences.

DIFFICULTIES IN SPACING EXPERIMENTS

As will be seen from the data of the experiments, many irregularities were encountered, both in the stands obtained and in the yields of individual rows where the stands were not unequal and the conditions were as uniform as could be provided. In view of these irregularities it will be understood that misleading inferences may easily be drawn if only the total yields of spacing experiments are reported and used as a basis of comparison.

One of the facts to be considered in spacing experiments is the sharp contrast that may appear between the outside rows of adjoining blocks that represent different spacings or between outside and inside rows of the same block.

It often happens that the outside rows of the close spacing give higher yields than the adjoining outside rows of a wider spacing and also higher yields than the inside rows of the close spacing. It appears that the outside rows of the close spacing often rob the outside rows of an adjoining wider spacing. Allowance can be made for this robbing effect by limiting the comparisons of yields to the inside rows of the blocks, although it is a mistake to disregard the evidence afforded by the relations of the outside rows that the close-spaced plants so often gain a pronounced advantage over the wide spacing. Also it is possible that the inside rows of the close-spaced block may suffer to some extent from the competition of the more robust plants in the outside rows. On the other hand, a restriction of the plants in the outside rows of the open-spaced cotton may afford some advantage to the inside rows.

It may appear that the effects of the different spacings may be determined more accurately by increasing the number of rows in the blocks so that the extent of the robbing or competition between the rows can be ascertained.

One of the experiments in 1923 was made with 5-row blocks, but different spacings yielded nearly the same, and the stands were irregular, so that no consistent differences were detected between the inside and the outside rows.

SPACING EXPERIMENTS IN 1921

COMPARISON OF 6-INCH AND 12-INCH SPACINGS

In 1921 a comparison was made of 6-inch with 12-inch spacing. The date of planting, date of thinning and size of plants at thinning, the spacing, length of rows, number of plants per row, and yields of seed cotton by rows and blocks are given in Table 1. The yields are also shown graphically in Figure 1. The same plan will be followed in presenting similar data regarding all of the experiments.

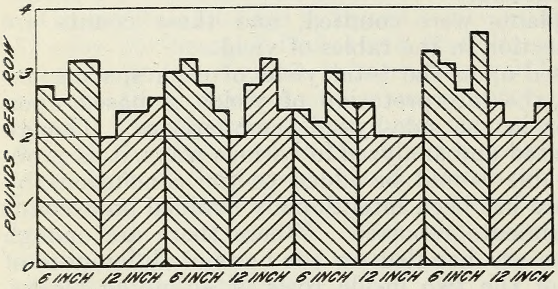


FIG. 1.—Yields (in pounds) of seed cotton per row from comparison of 6-inch and 12-inch spacings, Greenville, Tex., 1921

TABLE 1.—*Comparative yields from cotton plants in 6-inch and 12-inch spacings, Greenville, Tex., 1921*

The rows, which were 100 feet long, were planted May 10 and thinned June 6 when the plants were about 6 inches high and were bearing an average of about four true leaves]

Spacing	Row No.	Number of plants	Yield of seed cotton (pounds)	Spacing	Row No.	Number of plants	Yield of seed cotton (pounds)
6-inch (block 1)	1	210	2.8	6-inch (block 5)	1	189	2.4
	2	186	2.6		2	194	2.2
	3	210	3.2		3	205	3.0
	4	212	3.2		4	188	2.5
Total		818	11.8	Total		776	10.1
12-inch (block 2)	1	102	2.0	12-inch (block 6)	1	105	2.5
	2	102	2.4		2	108	2.0
	3	120	2.4		3	108	2.0
	4	106	2.6		4	103	2.0
Total		430	9.4	Total		424	8.5
6-inch (block 3)	1	184	3.0	6-inch (block 7)	1	204	3.3
	2	206	3.2		2	203	3.1
	3	208	2.8		3	206	2.7
	4	198	2.4		4	197	3.6
Total		796	11.4	Total		810	12.7
12-inch (block 4)	1	130	2.0	12-inch (block 8)	1	111	2.5
	2	106	2.8		2	105	2.2
	3	110	3.2		3	128	2.2
	4	108	2.4		4	104	2.5
Total		454	10.4	Total		448	9.4

In this experiment the bolls opened early in the season, and the entire crop was harvested at one picking. An unusually heavy boll-weevil infestation destroyed most of the bolls set late in the season and accounts for the crop being harvested in one picking.

A comparison of the yields, which are given in Table 1 and shown graphically in Figure 1, shows that the 6-inch spacing outyielded the 12-inch spacing. In the 7 side-by-side comparisons of the two inside rows the 6-inch spacings gave higher yields in 5 cases. The mean increase in pounds of seed cotton from the two inside rows of each block of the 6-inch spacing over the two inside rows of adjacent blocks of the 12-inch spacing is 0.828 ± 0.240 pound, a difference of 3.45 times the probable error. In this comparison the inside rows of the 6-inch spaced plants produced 18.7 per cent more seed cotton than the 12-inch spaced plants.

SPACING EXPERIMENTS IN 1922

Two comparisons of unthinned rows with rows in which the plants were spaced 6 and 12 inches apart in the drill and one experiment with plantings in hills were made in 1922.

The summer of 1922 was very dry at Greenville, the only rain of importance being 1.37 inches, which fell on August 7, after many cotton bolls were already open. Because of the very dry weather the plants grew to a height of only about 2 feet.

COMPARISON OF 6-INCH AND 12-INCH SPACINGS AND UNTHINNED ROWS

EXPERIMENT A

Yields from a test comparing unthinned with 6-inch and 12-inch spaced plants (experiment A) are given in Table 2 and are shown graphically in Figure 2.

There is considerable fluctuation in the row yields, but the tendency for the 6-inch spacing to produce more cotton than the 12-inch spacing and unthinned rows is evident. In five out of six comparisons the two inside rows of the blocks spaced 6 inches have produced more cotton than the two inside rows of adjoining unthinned blocks. The mean increase of the 6-inch spacing over the unthinned was 0.283 ± 0.104 pound, which is not significant. In making a similar comparison of 6-inch and 12-inch spacings, the 6-inch spacing gave higher yields in four out of six comparisons and also shows a mean increase over the 12-inch spacing of 0.283 ± 0.161 pound, which is not significant. In three out of four comparisons of the two inside rows of the 12-inch with unthinned blocks the 12-inch spacing produced more cotton, giving a mean increase of 0.275 ± 0.159 pound over the unthinned. This difference is also small and not significant.

Yields from adjoining rows in close-spaced and wider spaced blocks show that the outside rows of the close-spaced blocks often gave higher yields than the outside rows of the wider spacing, and also higher yields than the inside rows of the same blocks (fig. 2). For this reason the outside rows are not included in comparing yields of the different spacings.

Since no significant differences were obtained between the three spacings compared in this experiment, they may be considered as producing equally well. When yields are equal between thinned and unthinned comparisons the advantage would be in favor of the unthinned rows, as a part of the cost of chopping would be saved.

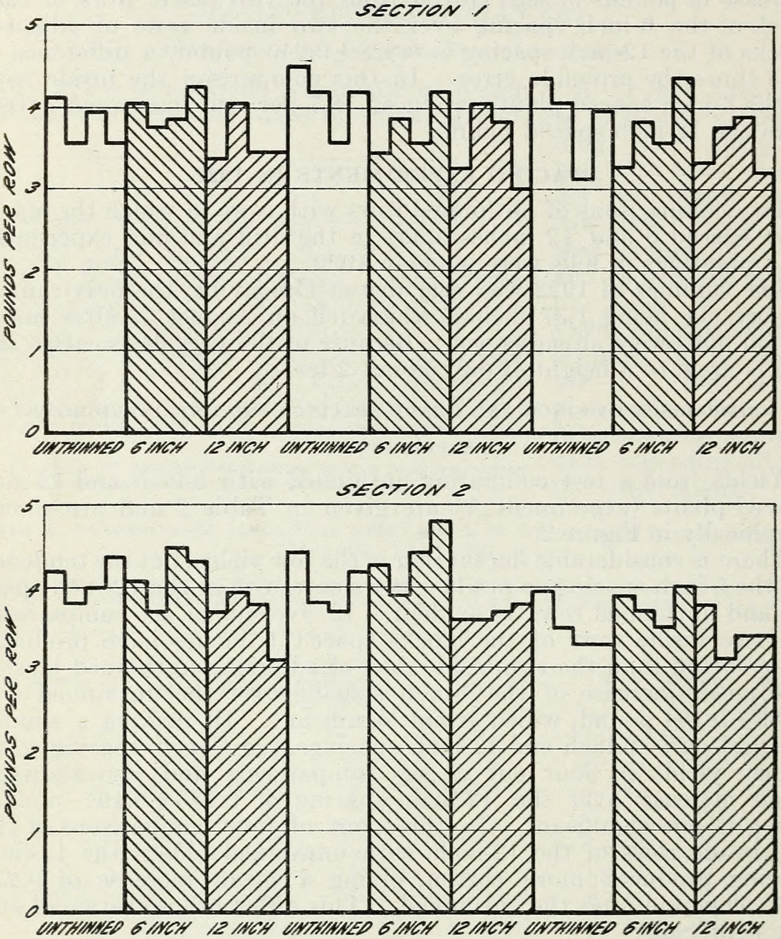


FIG. 2.—Yields (in pounds) of seed cotton per row from comparison of 6-inch and 12-inch spacings and unthinned rows in experiment A, Greenville, Tex., 1922

TABLE 2.—*Comparative yields in cotton-spacing experiment A (unthinned, 6-inch, and 12-inch spacings), Greenville, Tex., 1922*

[The rows in both sections were 150 feet long and were planted May 19, thinned June 29 (when the plants were 8 to 10 inches high and were bearing 9 or 10 true leaves), and picked Sept. 21]

Spacing	Row No.	Section 1		Section 2	
		Number of plants	Yield of seed cotton (pounds)	Number of plants	Yield of seed cotton (pounds)
Unthinned (block 1)	1	407	4.1	444	4.2
	2	330	3.6	319	3.8
	3	468	3.9	412	4.0
	4	376	3.6	315	4.4
Total		1,581	15.2	1,490	16.4
6-inch (block 2)	1	268	4.1	273	4.1
	2	255	3.8	211	3.7
	3	257	3.9	252	4.5
	4	261	4.3	230	4.3
Total		1,041	16.1	966	16.6
12-inch (block 3)	1	155	3.4	151	3.7
	2	155	4.1	142	3.9
	3	144	3.4	150	3.8
	4	152	3.4	153	3.1
Total		606	14.3	596	14.5
Unthinned (block 4)	1	390	4.5	411	4.4
	2	411	4.2	305	3.8
	3	409	3.6	394	3.7
	4	336	4.2	277	4.2
Total		1,546	16.5	1,387	16.1
6-inch (block 5)	1	222	3.4	237	4.3
	2	264	3.9	209	3.9
	3	235	3.6	250	4.4
	4	255	4.2	232	4.8
Total		976	15.1	928	17.4
12-inch (block 6)	1	157	3.3	151	3.6
	2	146	4.1	143	3.6
	3	155	3.8	164	3.7
	4	140	3.0	145	3.8
Total		598	14.2	603	14.7
Unthinned (block 7)	1	516	4.4	450	3.9
	2	456	4.1	484	3.5
	3	556	3.1	480	3.3
	4	610	3.9	514	3.3
Total		2,138	15.5	1,928	14.0
6-inch (block 8)	1	265	3.3	260	3.9
	2	267	3.8	248	3.7
	3	264	3.6	265	3.5
	4	259	4.4	256	4.0
Total		1,055	15.1	1,029	15.1
12-inch (block 9)	1	154	3.3	201	3.8
	2	145	3.8	145	3.1
	3	153	3.9	169	3.4
	4	144	3.2	145	3.4
Total		596	14.2	660	13.7

EXPERIMENT B

Yields from a second comparison of 6-inch and 12-inch spacings with unthinned rows (experiment B) are given in Table 3 and are shown graphically in Figure 3. The entire crop was harvested at one picking, which was done September 25.

The growing season was extremely dry and there was little difference in the development of the plants in the different spacings and likewise little difference in the yields.

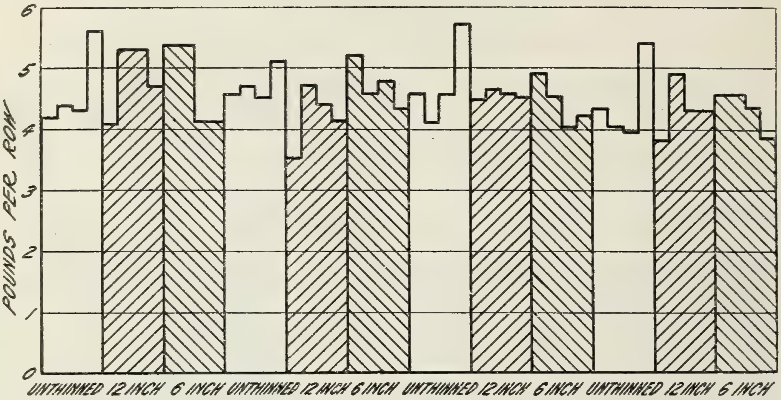
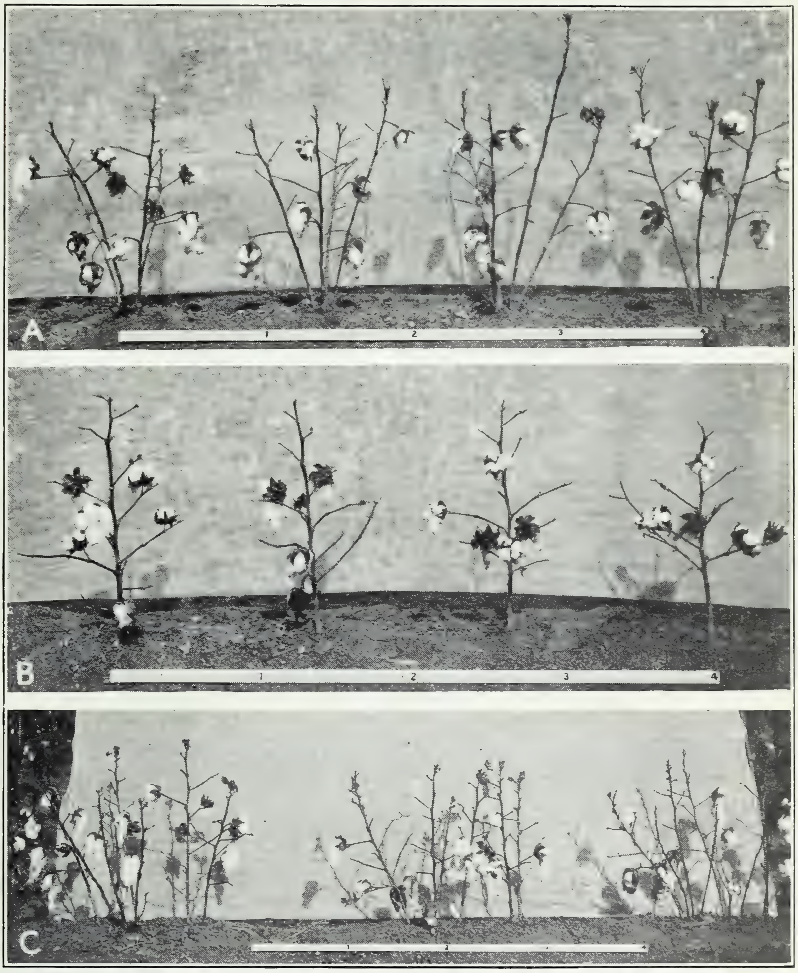


FIG. 3.—Yields (in pounds) of seed cotton per row from comparison of 6-inch and 12-inch spacings and unthinned rows in experiment B, Greenville, Tex., 1922

TABLE 3.—*Comparative yields in cotton-spacing experiment B (unthinned, 6-inch, and 12-inch spacings), Greenville, Tex., 1922*

[The rows, which were 100 feet long, were planted May 23, thinned June 29 (when the plants were 7 to 9 inches high and were bearing five to eight true leaves), and picked Sept. 25]

Spacing	Row No.	Number of plants	Yield of seed cotton (pounds)	Spacing	Row No.	Number of plants	Yield of seed cotton (pounds)
Unthinned (block 1)	1	274	4.2	Unthinned (block 7)	1	294	4.6
	2	263	4.4		2	222	4.1
	3	279	4.3		3	246	4.6
	4	284	5.6		4	284	5.7
Total		1,100	18.5	Total		1,046	19.0
12-inch (block 2)	1	114	4.1	12-inch (block 8)	1	100	4.4
	2	102	5.3		2	104	4.6
	3	106	5.3		3	104	4.6
	4	108	4.7		4	103	4.5
Total		430	19.4	Total		411	18.1
6-inch (block 3)	1	192	5.4	6-inch (block 9)	1	191	4.9
	2	150	5.4		2	170	4.5
	3	168	4.1		3	179	4.0
	4	188	4.1		4	170	4.2
Total		698	19.0	Total		710	17.6
Unthinned (block 4)	1	361	4.6	Unthinned (block 10)	1	403	4.3
	2	347	4.7		2	333	4.0
	3	312	4.5		3	393	3.9
	4	353	5.1		4	412	5.4
Total		1,373	18.9	Total		1,541	17.6
12-inch (block 5)	1	101	3.5	12-inch (block 11)	1	104	3.8
	2	106	4.7		2	105	4.9
	3	103	4.4		3	103	4.3
	4	99	4.1		4	110	4.3
Total		409	16.7	Total		422	17.3
6-inch (block 6)	1	168	5.2	6-inch (block 12)	1	182	4.5
	2	169	4.6		2	241	4.5
	3	150	4.8		3	221	4.3
	4	167	4.3		4	190	3.8
Total		654	18.9	Total		834	17.1



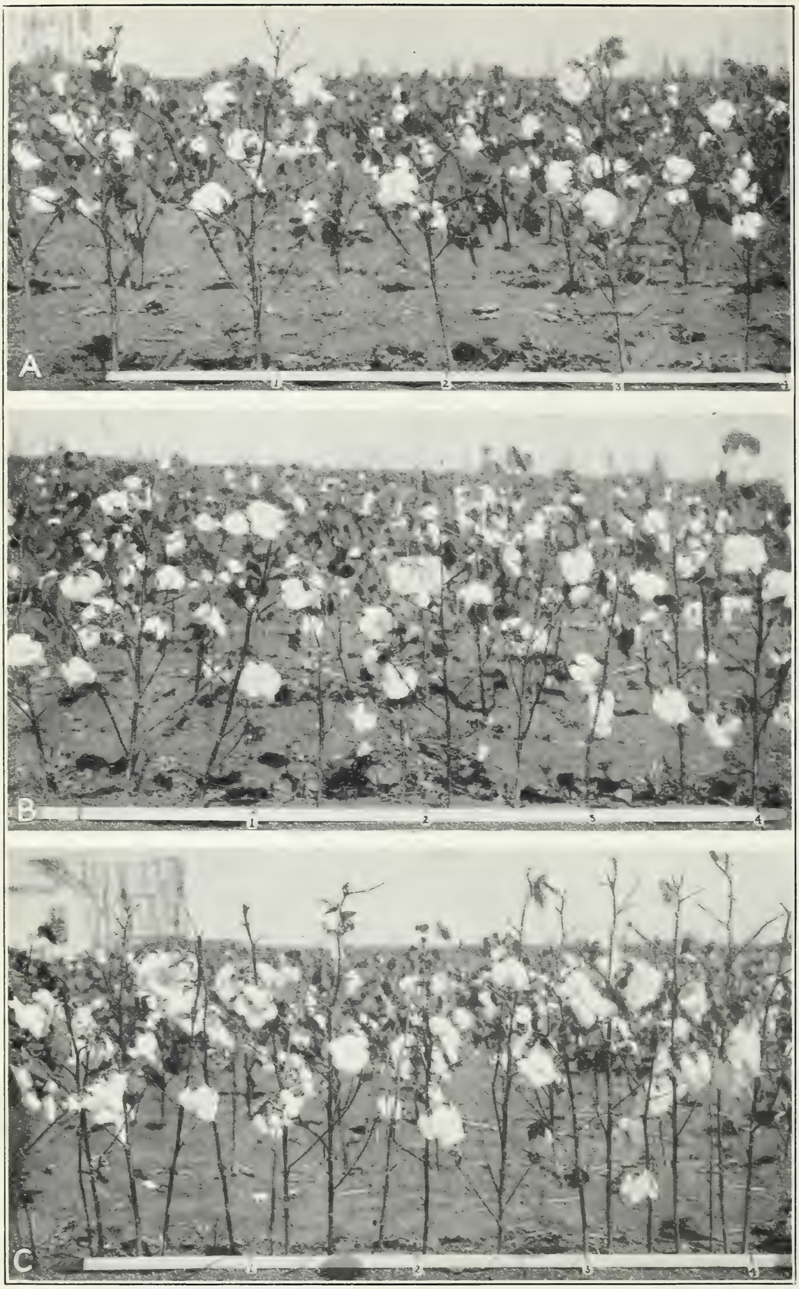
Fruiting Habits of Cotton Plants Variously Spaced

(Leaves removed from all plants to show fruiting habits)

A.—Several stalks to the hill. Plants so spaced usually give greater yields and mature earlier than single plants to the hill. (Compare with B)

B.—Single plants in hills about 18 inches apart. (Compare with A and see Table 4 for yields)

C.—Spacing of plants thinned by cross cultivating the rows



CHARACTERISTIC DEVELOPMENT OF COTTON PLANTS IN EXPERIMENT B IN 1923

A.—Plants spaced 12 inches apart
B.—Plants spaced 6 inches apart
C.—Plants in rows left unthinned

There is considerable variation in row yields for the different spacings, the outside rows of adjoining blocks of different spacings showing some wide differences. Comparing the row yields from the different spacings shown graphically in Figure 3, the variation of the border rows is very evident. In every case where a close-spaced block adjoins a wider spaced block the outside row of the closer spaced blocks shows an increase in yield.

Comparing the sum of the yields of the two inside rows of the unthinned blocks with the inside rows of the 12-inch spacing, this spacing shows higher yields in three out of four comparisons. In three comparisons of unthinned rows with 6-inch spacing the 6-inch spaced blocks have given slightly higher yields. Comparing the 6-inch and 12-inch spacing, the 12-inch has exceeded the 6-inch in three out of four comparisons. Comparing yields of the two inside rows of unthinned blocks with 12-inch spacing, in pounds of seed cotton, there is a mean increase of 0.90 ± 0.102 in favor of the inside rows of the 12-inch spacing. This difference is 8.8 times its probable error and may be regarded as significant. Making a similar comparison of the 6-inch with the 12-inch spacing, there is a mean difference in the yield of 0.475 ± 0.216 in favor of the 12-inch spacing. This difference is only 2.2 times its probable error and is not significant. As only three comparisons of block yields are available for the 6-inch spacing with the unthinned rows, probable error was not figured for them. There are indications, however, that the 6-inch spacing was the more desirable. The increase of the 12-inch spacing over the unthinned was equal to 10.4 per cent.

The row yields and block yields in this experiment indicate that the 6-inch and 12-inch spacings were a more desirable distance than was obtained in the unthinned rows and that the advantage in production appears to have been in favor of the wider spacing. This is the only experiment made during the 5-year period covered by this report in which the 12-inch spacing produced significantly more cotton than a spacing of less than 12 inches.

EXPERIMENT WITH PLANTINGS IN HILLS

In the experiment with hill plantings, hills with several plants were compared with hills thinned to one plant. The seeds were dropped by hand in hills an average distance of 21 inches apart. The test consists of three 4-row blocks, of which the two outer ones were thinned to one stalk to the hill and the inner block left unthinned. The rows which were not thinned averaged 2¼ plants to the hill. (Table 4 and fig. 4.)

This experiment was harvested in one picking. The yields from the two inside rows with several stalks to the hill were consistently higher than from the inside rows of the blocks thinned to one plant to the hill. This test indicates that more than one plant at 21 inches is needed if good yields are to be expected. The inside rows from the blocks with several stalks to the hill produced about 22 per cent more cotton than the inside rows of the blocks thinned to one plant to the hill. Each row with several stalks to the hill produced more cotton than the thinned rows.

The development and fruiting habits of plants in rows with several stalks to the hill as compared with one stalk to the hill are shown in Plate 1, A and B.

TABLE 4.—*Comparative yields in cotton-spacing experiment with plantings in thinned and unthinned hills, Greenville, Tex., 1922*

[The rows in both sections were 150 feet long and were planted May 18, and thinned when the plants were bearing an average of six to seven true leaves]

Spacing[1]	Row No.	Section 1		Section 2	
		Number of plants	Yield of seed cotton (pounds)	Number of plants	Yield of seed cotton (pounds)
Hills thinned to 1 stalk	1	72	4.1	68	4.1
	2	81	3.9	78	4.4
	3	94	3.3	91	4.5
	4	68	4.1	73	3.6
Total		315	15.4	310	16.6
Hills unthinned	1	197	5.4	220	6.0
	2	232	5.5	216	5.2
	3	176	4.6	219	5.2
	4	141	4.7	189	5.3
Total		746	20.2	844	21.7
Hills thinned to 1 stalk	1	82	3.8	92	4.3
	2	92	4.4	110	5.0
	3	74	3.8	92	4.3
	4	90	4.1	78	4.7
Total		338	16.1	372	18.3

[1] Hills averaged 21 inches apart.

SPACING EXPERIMENTS IN 1923

The yields obtained from the close-spaced plants in the 1921 and 1922 experiments led to the undertaking of seven spacing experiments in 1923. In two experiments unthinned rows were compared with 6-inch and 12-inch spacing. In two other experiments unthinned rows were compared with chopped rows in which one or two plants were left in hills from 12 to 15 inches apart. Unthinned, one plant at 12 inches, and "blocked-out" rows were compared in one experiment. An experiment in which hills with several stalks were compared with hills thinned to one plant and a test comparing one stalk every 12 inches with rows thinned by cross cultivating completed the series.

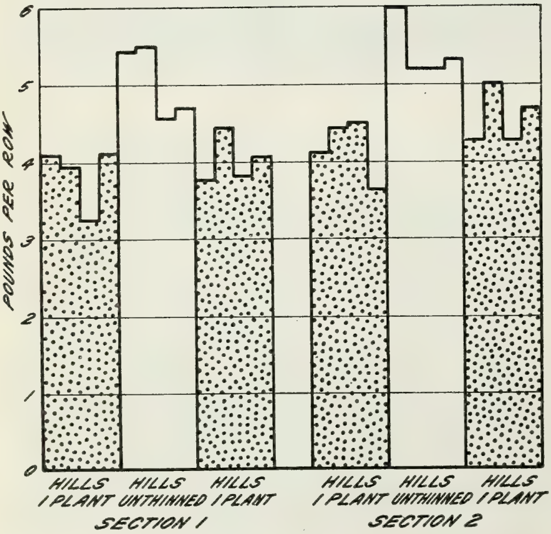


FIG. 4.—Yields (in pounds) of seed cotton per row from comparison of plantings in thinned and unthinned hills, Greenville, Tex., 1922

The growing season of 1923 was very dry, no rain of benefit to crops falling in northeastern Texas for a period of 70 days. This period began June 9 and lasted throughout the normal fruiting period of the cotton plants.

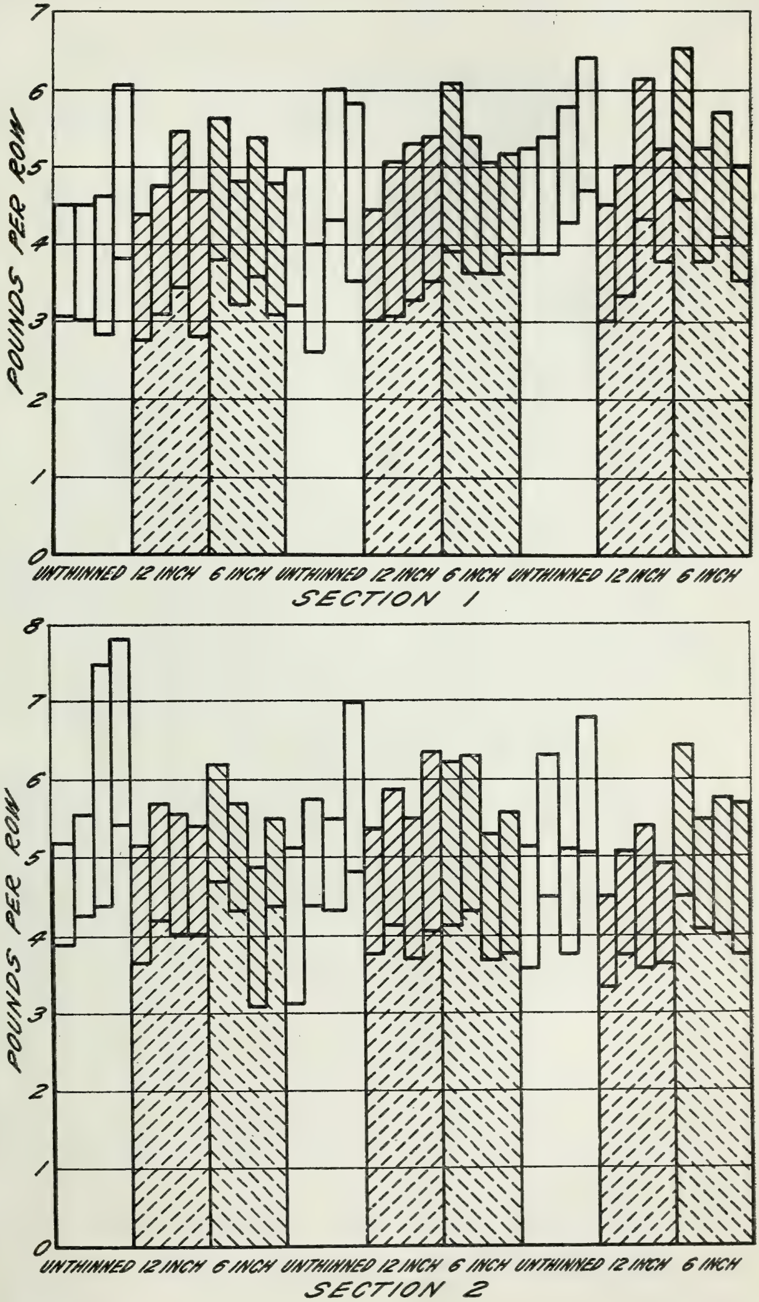


FIG. 5.—Yields (in pounds) of seed cotton per row from comparison of 6-inch and 12-inch spacings and unthinned rows in experiment A, Greenville, Tex., 1923

TABLE 5.—*Comparative yields in cotton-spacing experiment A (unthinned, 6-inch, and 12-inch spacings), Greenville, Tex., 1923*

[The rows in both sections were 150 feet long and were planted Apr. 17 and thinned June 1 (when the plants were 5 to 6 inches high bearing about five true leaves). The first picking was Aug. 18 and the second one Sept. 21]

Spacing	Row No.	Section 1				Section 2			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total
Unthinned (block 1)	1	455	3.1	1.4	4.5	394	3.9	1.3	5.2
	2	445	3.0	1.5	4.5	470	4.3	1.3	5,6
	3	439	2.8	1.8	4.6	404	4.4	3.1	7.5
	4	445	3.8	2.3	6.1	413	5.4	2.4	7.8
Total		1,784	12.7	7.0	19.7	1,681	18.0	8.1	26.1
12-inch (block 2)	1	176	2.8	1.6	4.4	107	3.6	1.6	5.2
	2	142	3.1	1.6	4.7	135	4.2	1.5	5.7
	3	140	3.4	2.0	5.4	130	4.0	1.6	5.6
	4	130	2.8	1.9	4.7	139	4.0	1.4	5.4
Total		588	12.1	7.1	19.2	511	15.8	6.1	21.9
6-inch (block 3)	1	262	3.8	1.8	5.6	229	4.7	1.5	6.2
	2	290	3.2	1.6	4.8	283	4.3	1.4	5.7
	3	233	3.6	1.8	5.4	188	3.1	1.8	4.9
	4	266	3.1	1.7	4.8	243	4.4	1.1	5.5
Total		1,051	13.7	6.9	20.6	943	16.5	5.8	22.3
Unthinned (block 4)	1	510	3.2	1.8	5.0	420	3.1	2.0	5.1
	2	605	2.6	1.4	4.0	683	4.4	1.4	5.8
	3	587	4.3	1.7	6.0	413	4.3	1.2	5.5
	4	630	3.5	2.3	5.8	590	4.8	2.2	7.0
Total		2,332	13.6	7.2	20.8	2,106	16.6	6.8	23.4
12-inch (block 5)	1	174	3.0	1.4	4.4	166	3.8	1.6	5.4
	2	162	3.1	2.0	5.1	165	4.1	1.7	5.8
	3	152	3.3	2.0	5.3	149	3.7	1.8	5.5
	4	169	3.5	1.9	5.4	169	4.1	2.3	6.4
Total		657	12.9	7.3	20.2	649	15.7	7.4	23.1
6-inch (block 6)	1	290	3.9	2.1	6.0	266	4.1	2.1	6.2
	2	296	3.6	1.8	5.4	283	4.3	2.0	6.3
	3	261	3.6	1.4	4.0	205	3.7	1.6	5.3
	4	277	3.9	1.3	5.2	251	3.8	1.8	7.0
Total		1,124	15.0	6.6	21.6	1,005	15.9	7.5	23.4
Unthinned (block 7)	1	418	3.9	1.4	5.3	318	3.6	1.6	5.2
	2	378	3.9	1.5	5.4	591	4.5	1.8	6.3
	3	456	4.3	1.5	5.8	363	3.8	1.3	5.1
	4	468	4.7	1.7	6.4	630	5.1	1.7	6.8
Total		1,720	16.8	6.1	22.9	1,902	17.0	6.4	23.4
12-inch (block 8)	1	185	3.0	1.5	4.5	165	3.3	1.2	4.5
	2	149	3.3	1.7	5.0	167	3.8	1.3	5.1
	3	172	4.3	1.8	6.1	160	3.6	1.8	5.4
	4	145	3.8	1.4	5.2	156	3.6	1.3	4.9
Total		651	14.4	6.4	20.8	648	14.3	5.6	19.9
6-inch (block 9)	1	292	4.6	1.9	6.5	297	4.5	1.9	6.4
	2	257	3.8	1.4	5.2	311	4.1	1.4	5.5
	3	259	4.1	1.6	5.7	262	4.0	1.8	5.8
	4	279	3.5	1.5	5.0	294	3.8	1.9	5.7
Total		1,087	16.0	6.4	22.4	1,164	16.4	7.0	23.4

COMPARISON OF 6-INCH AND 12-INCH SPACINGS AND UNTHINNED ROWS

EXPERIMENT A

Experiment A is so designated to differentiate it from another test in which 6-inch and 12-inch spacings were compared with unthinned rows. (Table 5 and fig. 5.)[1]

There was no outstanding difference in yields of the three spacings compared. The rows giving highest yields usually occur in the unthinned blocks but are often those which adjoin a wider spacing (fig. 5).

In three out of six comparisons between the inside rows of the unthinned blocks with the inside rows of the 12-inch spaced blocks, the unthinned rows gave greater yields. One comparison was a tie and two were in favor of the 12-inch spacing. The mean increase in favor of the unthinned rows is 0.233 ± 0.286 pound of seed cotton. Since the probable error is greater than the difference, the increase is not significant.

In making a similar comparison of six adjoining blocks of 6-inch and 12-inch spacing, the 6-inch blocks give higher yields in only three cases, but the mean difference, 0.05 ± 0.146 was in favor of the 6-inch spacing. This difference is less than the probable error and is not significant.

Only four comparisons are possible between the unthinned and the 6-inch spacing. The unthinned rows gave higher yields in only two of these comparisons, but show a mean increase over the 6-inch spacing of 0.275 ± 0.202 pound of seed cotton. This difference is only 1.36 times the probable error and is not significant. Though the close-spaced cotton gave a slightly higher total yield in all of the comparisons, the increase was too small to be considered significant and the spacings compared should be regarded as producing equally well.

EXPERIMENT B

Experiment B is also a comparison of unthinned rows with 6-inch and 12-inch spacings. By planting delinted seed at the rate of about 40 pounds to the acre an exceptionally thick stand of plants was obtained. This heavy planting of seed, which produced a stand of plants spaced extremely close, was made for the purpose of studying the effect on what would be considered badly over-crowded plants.

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[1] In Figures 5 to 18, inclusive, the lower, heavily shaded portions of the columns represent the first picking and the upper portions the second picking.

On fertile soil with ample moisture the unusually large number of plants left in the unthinned rows probably would have developed into slender "whips" and borne little fruit. As it happened, however, the season was very dry and the plants were held in check, so that at maturity they were scarcely 24 inches in height. (Table 6 and fig. 6.)

There is considerable fluctuation in the row yields and block yields in both pickings. There appears to be a tendency for the unthinned blocks to produce less cotton in the first picking than the 6-inch spacings.

Comparing the yields from the inside rows of the unthinned blocks with those of the 6-inch spacings, the latter gave the highest yields in two out of four cases. The 6-inch spacing gave higher yields than the 12-inch in two out of four comparisons. In one comparison they produced the same, and in the fourth the 12-inch spacing was highest. In the three comparisons of unthinned blocks with 12-inch spacing the unthinned gave the highest yield in each case.

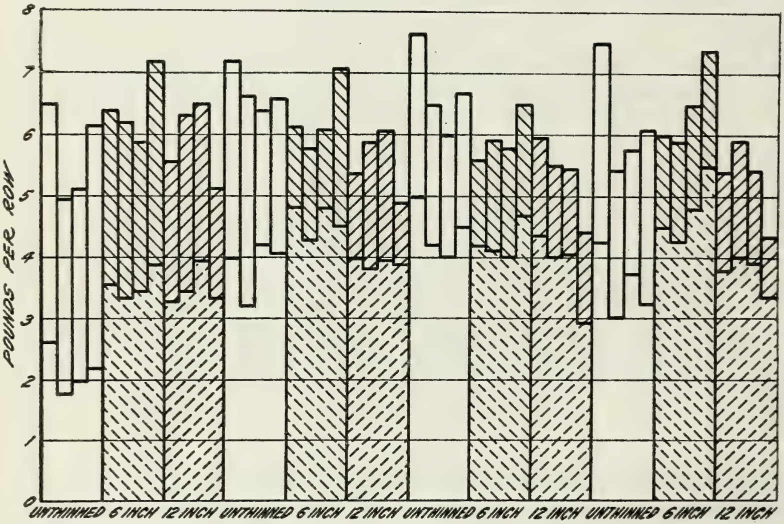

FIG. 6.—Yields (in pounds) of seed cotton per row from comparison of 6-inch and 12-inch spacings and unthinned rows in experiment B, at Greenville, Tex., 1923

Comparing yields of the unthinned rows with the 6-inch spacing there is a mean difference of 0.30 ± 0.541 pound in favor of the two inside rows of the 6-inch spacing. The difference is slight and is not significant. Comparing yields from the two inside rows of the 6-inch and 12-inch spacings, there is a mean difference of 0.225 ± 0.293 in favor of the 6-inch one, which is not significant. Since there are only three comparisons between the 12-inch and the unthinned rows, mean differences were not calculated, but the unthinned blocks have produced more cotton in each case.

The yield relations of the different spacings are shown in Figure 6, and the size and fruiting habits of the plants from the different spacings of the experiment are shown in Plate 2.

TABLE 6.—*Comparative yields in cotton-spacing experiment B (unthinned, 6-inch and 12-inch spacings), Greenville, Tex., 1923*

The rows, which were 150 feet long, were planted May 8 and thinned June 9 (when the plants were 5 to 8 inches high and bearing four or five true leaves). The first picking was Aug. 28 and the second one Sept. 22]

Spacing	Row No.	Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total
Unthinned (block 1)	1	963	2.6	3.9	6.5
	2	895	1.8	3.2	5.0
	3	877	2.0	3.1	5.1
	4	861	2.2	3.9	6.1
Total	------	3,596	8.6	14.1	22.7
6-inch (block 2)	1	312	3.6	2.8	6.4
	2	316	3.3	2.9	6.2
	3	291	3.4	2.4	5.8
	4	291	3.9	3.3	7.2
Total	------	1,210	14.2	11.4	25.6
12-inch (block 3)	1	156	3.3	2.3	5.6
	2	160	3.4	2.9	6.3
	3	173	3.9	2.6	6.5
	4	152	3.3	1.8	5.1
Total	------	641	13.9	9.6	23.5
Unthinned (block 4)	1	778	4.0	3.2	7.2
	2	823	3.2	3.4	6.6
	3	667	4.2	2.2	6.4
	4	823	4.1	2.5	6.6
Total	------	3,091	15.5	11.3	26.8
6-inch (block 5)	1	356	4.8	1.3	6.1
	2	265	4.3	1.5	5.8
	3	298	4.8	1.3	6.1
	4	232	4.5	2.6	7.1
Total	------	1,151	18.4	6.7	25.1
12-inch (block 6)	1	147	4.0	1.4	5.4
	2	187	3.8	2.1	5.9
	3	169	3.9	2.1	6.0
	4	161	3.9	1.0	4.9
Total	------	664	15.6	6.6	22.2
Unthinned (block 7)	1	801	5.0	2.6	7.6
	2	538	4.2	2.3	6.5
	3	806	4.0	2.0	6.0
	4	746	4.5	2.2	6.7
Total	------	2,891	17.7	9.1	26.8
6-inch (block 8)	1	325	4.2	1.4	5.6
	2	336	4.1	1.8	5.9
	3	287	4.0	1.8	5.8
	4	308	4.7	1.8	6.5
Total	------	1,256	17.0	6.8	23.8
12-inch (block 9)	1	163	4.4	1.6	6.0
	2	161	4.0	1.5	5.5
	3	142	4.1	1.4	5.5
	4	133	2.9	1.5	4.4
Total	------	599	15.4	6.0	21.4
Unthinned (block 10)	1	955	4.3	3.2	7.5
	2	828	3.0	2.4	5.4
	3	831	3.8	2.0	5.8
	4	902	3.3	2.8	6.1
Total	------	3,516	14.4	10.4	24.8
6-inch (block 11)	1	330	4.5	1.5	6.0
	2	328	4.3	1.6	5.9
	3	288	4.8	1.7	6.5
	4	287	5.5	1.9	7.4
Total	------	1,233	19.1	6.7	25.8
12-inch (block 12)	1	139	3.8	1.6	5.4
	2	166	4.1	1.9	6.0
	3	157	3.9	1.5	5.4
	4	146	3.4	1.0	4.4
Total	------	608	15.2	6.0	21.2

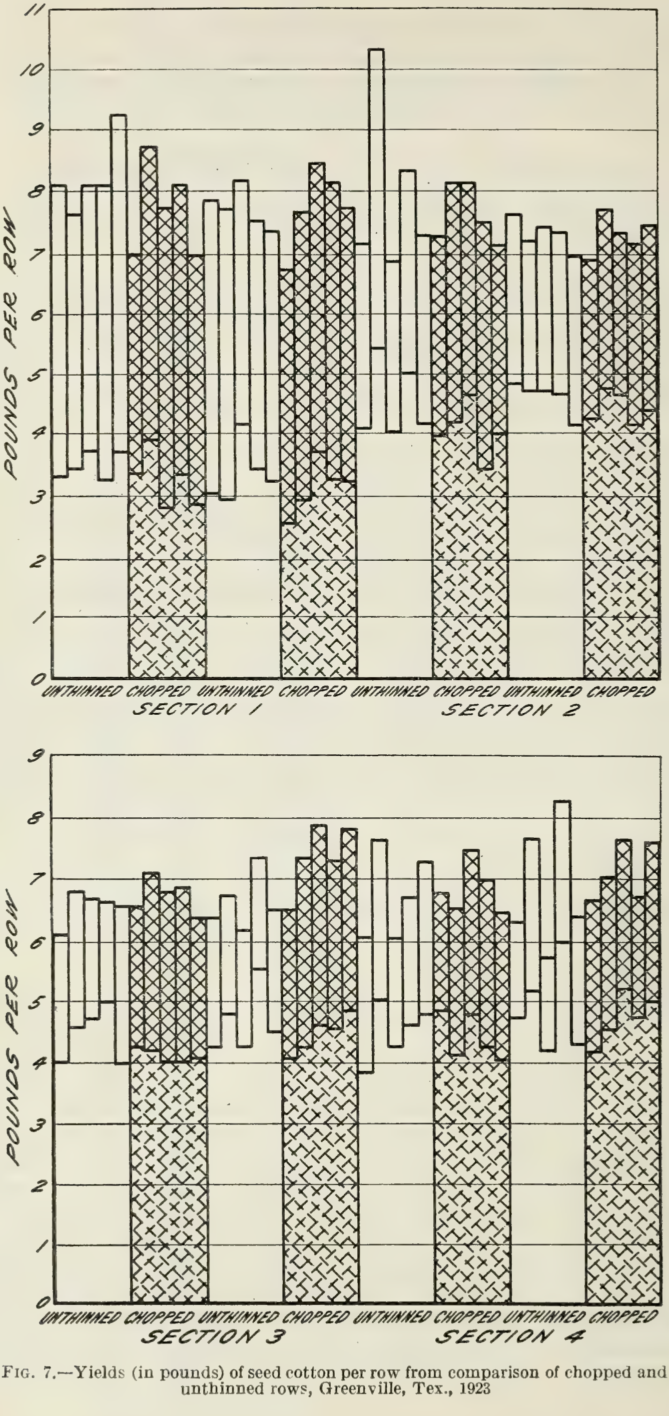

FIG. 7.—Yields (in pounds) of seed cotton per row from comparison of chopped and unthinned rows, Greenville, Tex., 1923

COMPARISON OF CHOPPED AND UNTHINNED ROWS

In another experiment, chopped rows in which one or two plants were left in hills from 12 to 15 inches apart were compared with rows left unthinned. (Table 7 and fig. 7.)

There is little difference in the yields from the two spacings. A few rows show rather wide fluctuation, but on the whole the yields from both spacings are fairly uniform. The most noticeable difference in yields in this test is the low yields in the first picking of section 1. The soil in this section was a little heavier and not so rolling as the remaining three sections, which may account for the difference. In the second picking, however, the yields were largest from this section. Another notable feature in regard to row yields is the unusually high yield from the second row of the first block of unthinned rows in section 2. A reason for the high yield in this row is found in that it had 145 more plants than the first row and 107 more plants than the third row. The low number of plants in the adjoining rows gave the advantage to the row with the greater number of plants. The relation of the row yields from the different spacings are shown in Figure 7.

TABLE 7.—*Comparative yields in cotton-spacing experiment with chopped and unthinned rows, Greenville, Tex., 1923*

[The rows in the four sections were 150 feet long and were planted Apr. 13 and chopped May 28 (when the plants were about 5 inches high and bearing four or five true leaves). The first picking was Aug. 18 and the second one Sept. 22]

Spacing	Row No.	Section 1				Section 2			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total
Unthinned (block 1)	1	347	3.3	4.8	8.1	287	4.1	3.1	7.2
	2	390	3.4	4.2	7.6	432	5.4	4.9	10.3
	3	337	3.8	4.3	8.1	325	4.1	2.8	6.9
	4	352	3.3	4.8	8.1	425	5.1	3.3	8.4
	5	364	3.8	5.5	9.3	393	4.2	3.1	7.3
Total		1,790	17.6	23.6	41.2	1,862	22.9	17.2	40.1
Chopped (block 2)	1	150	3.4	3.6	7.0	178	4.0	3.3	7.3
	2	239	3.9	4.8	8.7	250	4.3	3.9	8.2
	3	201	2.8	4.9	7.7	203	4.7	3.5	8.2
	4	228	3.4	4.8	8.2	209	3.4	4.1	7.5
	5	109	2.9	4.1	7.0	217	4,1	3.1	7.2
Total		927	16.4	22.2	38.6	1,057	20.5	17.9	38.4
Unthinned (block 3)	1	410	3.1	4.8	7.9	393	4.9	2.8	7.7
	2	305	2.9	4.8	7.7	467	4.8	2.5	7.3
	3	475	4.2	4.0	8.2	430	4.8	2.7	7.5
	4	425	3.4	4.1	7.5	618	4.7	2.7	7.4
	5	375	3.3	4.1	7.4	384	4.2	2.8	7.0
Total		1,990	16.9	21.8	38.7	2,292	23.4	13.5	36.9
Chopped (block 4)	1	168	2.6	4.2	6.8	175	4.3	2.6	6.9
	2	245	2.9	4.8	7.7	226	4.8	2.9	7.7
	3	193	3.8	4.7	8.5	204	4.7	2.7	7.4
	4	200	3.3	4.9	8.2	193	4.2	3.0	7.2
	5	185	3.3	4.5	7.8	176	4.4	3.1	7.5
Total		991	15.9	23.1	39.0	974	22.4	14.3	36.7

TABLE 7.—*Comparative yields in cotton-spacing experiment with chopped and unthinned rows, Greenville, Tex., 1923*—Continued

Spacing	Row No.	Section 3				Section 4			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total
Unthinned (block 5)	1	307	4.0	2.1	6.1	252	3.8	2.3	6.1
	2	552	4.6	2.2	6.8	505	5.1	2.6	7.7
	3	530	4.7	2.0	6.7	240	4.3	1.8	6.1
	4	543	5.0	1.6	6.6	461	4.6	2.1	6.7
	5	417	4.4	2.1	6.5	382	4.8	2.5	7.3
Total	------	2,349	22.7	10.0	32.7	1,840	22.6	11.3	33.9
Chopped (block 6)	1	180	4.3	2.2	6.5	182	4.9	1.9	6.8
	2	211	4.2	2.9	7.1	188	4.1	2.4	6.5
	3	182	4.0	2.8	6.8	199	4.8	2.7	7.5
	4	188	4.0	2.9	6.9	173	4.3	2.7	7.0
	5	191	4.1	2.3	6.4	179	4.1	2.4	6.5
Total	------	952	20.6	13.1	33.7	921	22.2	12.1	34.3
Unthinned (block 7)	1	369	4.3	2.1	6.4	258	4.8	1.6	6.4
	2	494	4.8	1.9	6.7	553	5.2	2.5	7.7
	3	466	4.3	1.9	6.2	284	4.2	1.6	5.8
	4	647	5.6	1.8	7.4	567	6.0	2.3	8.3
	5	348	4.5	2.0	6.5	285	4.3	2.1	6.4
Total	------	2,324	23.5	9.7	33.2	1,947	24.5	10.1	34.6
Chopped (block 8)	1	187	4.1	2.4	6.5	179	4.2	2.5	6.7
	2	195	4.3	3.1	7.4	185	4.6	2.5	7.1
	3	229	4.6	3.3	7.9	202	5.3	2.4	7.7
	4	175	4.6	2.8	7.4	178	4.8	2.0	6.8
	5	171	4.9	2.9	7.8	185	5.1	2.6	7.7
Total	------	957	22.5	14.5	37.0	929	24.0	12.0	36.0

This experiment was harvested in four sections, giving 12 block comparisons between the two spacings. In 9 of the 12 comparisons the inside rows of the chopped blocks gave the highest yields. The increase in yield of one spacing over the other is usually small, and the differences are probably due to chance.

Comparing yields in pounds of seed cotton from the three inside rows of each block, the chopped rows show a mean difference of 0.517 ±0.216 pound over the unthinned rows. This difference is only 2.39 times its probable error and is not significant. As there was practically no difference in yield between the chopped rows and the unthinned rows, the real difference appears to be in the cost of the chopping.

COMPARISON OF CHOPPED AND UNTHINNED ROWS AT CAMPBELL, TEX.

An experiment comparing chopped and unthinned rows was made on the farm of L. C. Cooper, near Campbell, on fine sandy loam soil. The choppers were instructed to chop out the rows to one or two stalks to the hill, leaving the hills about 12 inches apart. Eight-inch hoes were used and, as is usually the case where thinning is done with a hoe, the plants were left at distances greater than was desired. (Table 8.)

In this test there is a very definite difference in yield between the two spacings, especially in the first picking. In 8 out of 10 comparisons, the two inside rows of the unthinned blocks produced more cotton than the chopped blocks. In one comparison the yield was a tie and in another a chopped block produced slightly more than the unthinned.

The yields from both spacings are much higher on one side of section 1 than on the other side. (Fig. 8.) This gives the unthinned blocks some advantage in total yield, but since the yields are interpreted on the basis of differences of the two inside rows of adjoining blocks of the different spacings, this advantage is small.

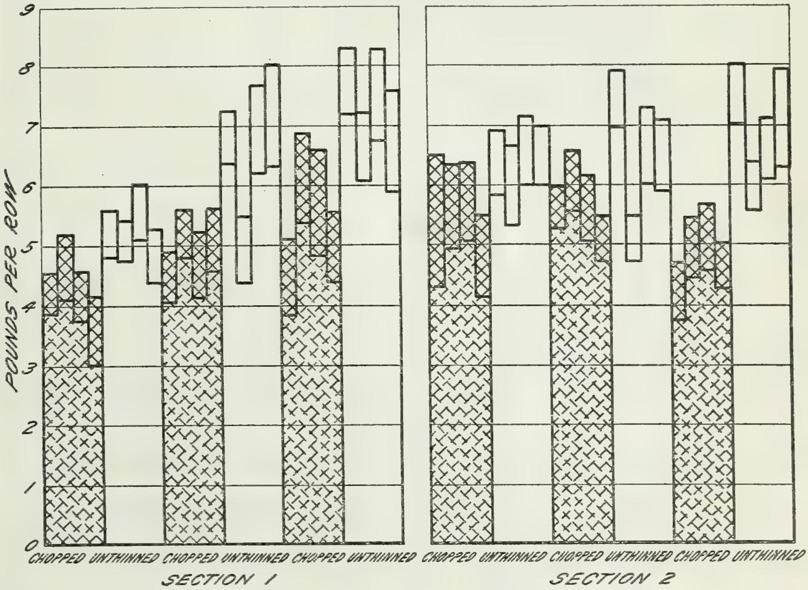

FIG. 8.—Yields (in pounds) of seed cotton per row from comparison of chopped and unthinned rows, Campbell, Tex., 1923

Considering yields from the two inside rows of each block, there is a mean difference of 1.28 ± 0.204 pounds in favor of the unthinned rows. This difference is 6.4 times its probable error and is very significant. The mean difference corresponds to an increase of 10.8 per cent in the unthinned rows, whereas the difference between the mean yields is 1.6 pounds, corresponding to an increase of about 13.5 per cent.

The results of this experiment are in marked contrast to the preceding experiment made on black land with the same two spacings. The comparison made on black land about 12 miles distant from this comparison failed to show any significant differences in yield, whereas in this comparison the differences are very outstanding.

TABLE 8.—*Comparative yields in cotton-spacing experiment with chopped and unthinned rows, Campbell, Tex., 1923*

[The rows, which were 100 feet long, were planted May 7 and chopped June 5 (when the plants were 5 to 7 inches high and bearing five or six true leaves). The first picking was Sept. 10 and the second one Oct. 14]

Spacing	Row No.	Section 1				Section 2			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total
Chopped (block 1)	1	96	3.9	0.7	4.6	93	9.3	2.2	6.5
	2	95	4.1	1.1	5.2	87	4.9	1.4	6.3
	3	83	3.8	.9	4.7	91	5.1	1.3	6.4
	4	78	3.0	1.2	4.2	73	4.1	1.4	5.5
Total		352	14.8	3.9	18.7	344	18.4	6.3	24.7
Unthinned (block 2)	1	203	4.8	.8	5.6	229	5.8	1.1	6.9
	2	200	4.8	.7	5.5	192	5.3	1.4	6.7
	3	215	5.1	.9	6.0	228	6.0	1.2	7.2
	4	125	4.4	.9	5.3	152	6.0	1.0	7.0
Total		743	19.1	3.3	22.4	801	23.1	4.7	27.8
Chopped (block 3)	1	89	4.1	.9	5.0	89	5.3	.7	6.0
	2	89	4.8	.8	5.6	82	5.6	1.0	6.6
	3	81	4.1	1.1	5.2	91	5.1	1.1	6.2
	4	81	4.6	1.1	5.7	78	4.7	.8	5.5
Total		340	17.6	3.9	21.5	340	20.7	3.6	24.3
Unthinned (block 4)	1	196	6.4	.9	7.3	246	6.9	1.0	7.9
	2	143	4.4	1.1	5.5	131	4.7	.8	5.5
	3	209	6.2	1.5	7.7	244	6.0	1.3	7.3
	4	237	6.3	1.7	8.0	212	5.9	1.2	7.1
Total		785	23.3	5.2	28.5	833	23.5	4.3	27.8
Chopped (block 5)	1	78	3.8	1.3	5.1	75	3.7	1.0	4.7
	2	96	5.4	1.5	6.9	79	4.4	1.0	5.4
	3	92	4.8	1.8	6.6	91	4.6	1.1	5.7
	4	84	4.4	1.2	5.6	87	4.3	.8	5.1
Total		350	18.4	5.8	24.2	332	17.0	3.9	20.9
Unthinned (block 6)	1	207	7.2	1.1	8.3	212	7.0	1.0	8.0
	2	155	6.1	1.1	7.2	147	5.6	.8	6.4
	3	215	6.8	1.5	8.3	207	6.1	1.0	7.1
	4	233	5.9	1.7	7.6	187	6.3	1.6	7.9
Total		810	26.0	5.4	31.4	753	25.0	4.4	29.4

COMPARISON OF 12-INCH SPACING AND BLOCKED-OUT AND UNTHINNED ROWS

In another experiment 12-inch spacing and unthinned rows were compared with rows which had been blocked out with a hoe. The term "blocked out" refers to rows in which several plants are left a hoe's width apart, about half of the plants being removed. The 12-inch spacing was obtained by chopping out the stand to one plant to a hill approximately 12 inches apart. As is usually the case where the plants are chopped out with a hoe, the distance between the plants in the 12-inch spacing is slightly more than this distance. (Table 9.)

TABLE 9.—*Comparative yields in cotton-spacing experiment with unthinned, blocked-out, and 12-inch spacing, Greenville, Tex., 1923*

[The rows, which were 150 feet long, were planted Apr. 16 and thinned when the plants were about 6 inches high. The first picking was Aug. 28 and the second one Sept. 25]

Spacing	Row No.	Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total
12-inch (block 1)	1	199	7.7	1.3	9.0
	2	150	6.7	1.1	7.8
	3	145	5.8	1.1	6.9
	4	138	5.0	.9	5.9
Total	------	632	25.2	4.4	29.6
Blocked out (block 2)	1	232	6.5	1.2	7.7
	2	252	5.9	1.1	7.0
	3	289	5.3	.9	6.2
	4	224	5.2	.7	5.9
Total	------	997	22.9	3.9	26.8
Unthinned (block 3)	1	344	5.7	1.1	6.8
	2	255	5.8	.8	6.6
	3	397	6.6	.9	7.5
	4	394	7.2	1.2	8.4
Total	------	1,390	25.3	4.0	29.3
12-inch (block 4)	1	130	4.9	.8	5.7
	2	128	5.1	1.2	6.3
	3	143	6.1	1.4	7.5
	4	125	5.9	1.1	7.0
Total	------	526	22.0	4.5	26.5
Blocked out (block 5)	1	223	6.6	1.4	8.0
	2	177	6.2	1.4	7.6
	3	173	5.3	1.4	6.7
	4	183	4.8	1.4	6.2
Total	------	756	22.9	5.6	28.5
Unthinned (block 6)	1	433	6.5	1.3	7.8
	2	345	4.7	.9	5.6
	3	506	7.4	1.4	8.8
	4	241	5.6	1.2	6.8
Total	------	1,525	24.2	4.8	29.0
12-inch (block 7)	1	139	5.4	1.5	6.9
	2	123	5.2	1.3	6.5
	3	140	5.6	1.8	7.4
	4	123	4.3	1.5	5.8
Total	------	525	20.5	6.1	26.6
Blocked out (block 8)	1	258	6.5	1.7	8.2
	2	228	5.8	1.3	7.1
	3	218	5.1	1.5	6.6
	4	212	5.2	1.3	6.5
Total	------	916	22.6	5.8	28.4
Unthinned (block 9)	1	438	6.1	1.8	7.9
	2	271	5.9	1.4	7.3
	3	319	5.4	1.4	6.8
	4	335	6.3	1.8	8.1
Total	------	1,363	23.7	6.4	30.1

The row yields in all spacings showed some very wide fluctuations (fig. 9). These differences may be attributed partly to sporadic damage done by boll weevils, which were present in this experiment throughout the latter half of the growing season.

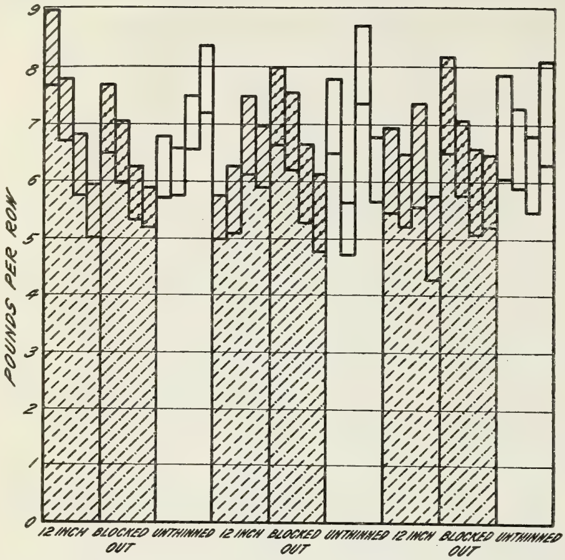

FIG. 9.—Yields (in pounds) of seed cotton per row from comparison of 12-inch spacing and blocked-out and unthinned rows, Greenville, Tex., 1923.

Comparing the sum of the yields of the two inside rows from each block, the unthinned in five comparisons produced more cotton than adjoining blocks of the 12-inch spacing and blocked-out rows. In two out of three comparisons the 12-inch blocks gave higher yields than the blocked-out ones. In three comparisons of blocked-out with unthinned, the unthinned produced more cotton in each case. In the only two comparisons available the unthinned blocks produced more cotton than the 12-inch spacing.

Since not more than three comparisons are available between the different spacing, mean differences have not been calculated. The mean row yields from the different spacings show a slight difference in favor of the unthinned rows, but this difference is not significant, and each spacing may be regarded as yielding equally well.

EXPERIMENT WITH PLANTINGS IN HILLS

Hills with several stalks were compared with hills thinned to one plant. The average distance between hills was 16 to 18 inches, and the hills which were not thinned had an average of 2½ plants. (Table 10.)

TABLE 10.—*Comparative yields in cotton-spacing experiment with plantings in thinned and unthinned hills, Greenville, Tex., 1923*

[The rows, which in each section were 100 feet long, were planted Apr. 18 and thinned June 9 (when the plants were 6 to 8 inches high and bearing five or six true leaves). The first picking was Aug. 30 and the second one Oct. 30]

Spacing	Row No.	Section 1				Section 2				Section 3			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total		First picking	Second picking	Total
Hills, one plant (block 1)	1	67	3.2	0.5	3.7	61	3.1	0.7	3.8	56	3.3	0.7	4.0
	2	74	3.7	.8	4.5	68	3.6	.7	4.3	65	3.7	.9	4.6
	3	61	3.4	.4	3.8	60	3.1	.7	3.8	70	3.6	.6	4.2
	4	85	3.3	.5	3.8	68	2.8	.7	3.5	81	4.0	.8	4.8
Total	----	287	13.6	2.2	15.8	257	12.6	2.8	15.4	272	14.6	3.0	17.6
Hills unthinned (block 2)	1	182	3.5	.8	4.3	168	3.6	.7	4.3	114	3.8	.8	4.6
	2	234	3.6	.6	4.2	200	3.3	.9	4.2	169	4.0	.8	4.8
	3	147	3.1	.7	3.8	145	3.4	.5	3.9	166	3.8	.7	4.5
	4	245	4.0	.8	4.8	202	3.9	.8	4.7	208	4.4	.8	5.2
Total	----	808	14.2	2.9	17.1	715	14.2	2.9	17.1	657	16.0	3.1	19.1
Hills, one plant (block 3)	1	74	3.3	.5	3.8	74	3.0	.5	3.5	74	3.6	.5	4.1
	2	69	3.6	.5	4.1	55	3.1	.5	3.6	64	4.0	.8	4.8
	3	69	3.4	.8	4.2	67	3.4	.6	4.0	72	3.8	.8	4.6
	4	68	3.4	.6	4.0	72	3.7	.7	4.4	76	4.1	.6	4.7
Total	----	280	13.7	2.4	16.1	268	13.2	2.3	15.5	286	15.5	2.7	18.2
Hills unthinned (block 4)	1	157	3.4	.8	4.2	115	3.1	.5	3.6	162	3.6	.9	4.5
	2	179	3.5	1.0	4.5	227	3.9	1.1	5.0	188	4.6	.7	5.3
	3	189	3.2	.8	4.0	117	2.9	.5	3.4	141	3.4	.7	4.1
	4	176	3.1	1.1	4.2	169	4.0	.6	4.6	176	4.4	1.0	5.4
Total	----	701	13.2	3.7	16.9	628	13.9	2.7	16.6	667	16.0	3.3	19.3

Comparing yields in pounds of seed cotton from the two inside rows of each block, the hills with several stalks gave the highest yields in four out of nine cases. In two of the comparisons the yields were tied, and three show a difference in favor of the rows thinned to one plant in a hill. There is a mean difference of 0.144 ± 0.089 pounds in favor of the two inside rows of the blocks with several stalks to the hill. As this difference is only 1.6 times its probable error, it is not significant.

The relation of row and block yields is shown graphically in Figure 10.

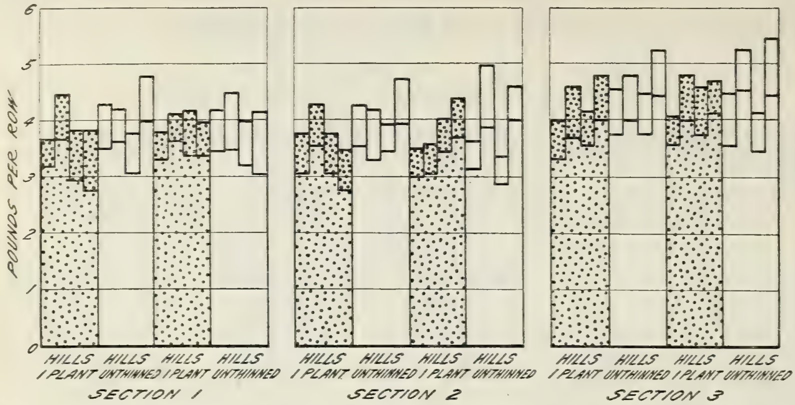

FIG. 10.—Yields (in pounds) of seed cotton per row from comparison of plantings in thinned and unthinned hills, Greenville, Tex., 1923

COMPARISON OF 12-INCH SPACING WITH ROWS THINNED BY CROSS CULTIVATION

Rows chopped to as near 12 inches as practicable were compared with rows thinned by cross cultivation. A 14-inch buzzard-wing sweep was attached to each cultivator gang and run crosswise of the row. In the center of the plot the gangs were raised and eight rows skipped. These eight rows were then chopped out. (Table 11 and fig. 11.)

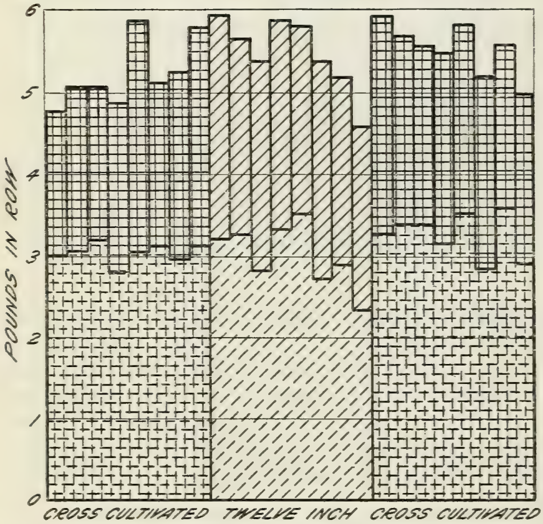

FIG. 11.—Yields (in pounds) of seed cotton per row from comparison of 12-inch spacing with rows thinned by cross cultivation, Greenville, Tex., 1923.

Because of cotton root rot killing a large number of plants in this test, the plot was harvested in a single 100-foot section, giving only two comparisons. Referring to Figure 11, showing the row yields, it will be seen that there is no consistent difference in yield between the two spacings. As the cost of thinning the rows by cross cultivating was much less than chopping out by hand, the crop from the cross-cultivated rows was produced at a saving over the chopped rows.

TABLE 11.—*Comparative yields in cotton-spacing experiment with 12-inch spacing and rows thinned by cross cultivation, Greenville, Tex., 1923*

[The rows, which were 100 feet long, were planted Apr. 17 and thinned when the plants were about 3½ inches high and bearing about four true leaves. The first picking was Aug. 24 and the second one Sept. 22]

Spacing	Row No.	Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total
Cross cultivated	1	214	3.0	1.8	4.8
	2	244	3.1	2.0	5.1
	3	253	3.2	1.9	5.1
	4	234	2.8	2.1	4.9
	5	235	3.1	2.8	5.9
	6	232	3.1	2.0	5.1
	7	214	2.9	2.3	5.2
	8	207	3.1	2.7	5.8
Total		1,833	24.3	17.6	41.9
Chopped to 12 inches	1	94	3.2	2.8	6.0
	2	95	3.3	2.4	5.7
	3	85	2.8	2.6	5.4
	4	90	3.3	2.6	5.9
	5	89	3.5	2.3	5.8
	6	88	2.7	2.7	5.4
	7	80	2.9	2.3	5.2
	8	78	2.3	2.3	4.6
Total		699	24.0	20.0	44.0
Cross cultivated	1	282	3.3	2.6	5.9
	2	218	3.4	2.3	5.7
	3	230	3.4	2.2	5.6
	4	197	3.1	2.4	5.5
	5	184	3.5	2.3	5.8
	6	188	2.8	2.4	5.2
	7	256	3.6	2.0	5.6
	8	220	2.9	2.1	5.0
Total		1,775	26.0	18.3	44.3

The development and fruiting habits of the plants in the cross-cultivated rows are shown in Plate 1, C.

SPACING EXPERIMENTS IN 1924

Two spacing experiments were conducted in 1924. A comparison of two plants every 12 inches with unthinned rows was made on the Houston clay soil of the Greenville station and a comparison of chopped rows with unthinned rows on fine sandy loam on the farm of L. C. Cooper, near Campbell.

The season of 1924 was extremely dry, no rainfall of benefit to crops being recorded at Greenville from May 24 until September 9. Practically all the cotton produced in the 1924 experiments was made during this dry period. The plants were damaged by grasshoppers, aphids, and seedling disorders during the spring, but boll weevils were not present.

These two experiments were planned to obtain a larger number of block comparisons and a larger number of individual row yields than were provided for in previous tests. The confidence that can be placed in yields from experiments of this kind should be associated with consistent behavior of row and block yields. The first requirement for showing differences of behavior is to get an adequate number of side-by-side block comparisons. These experiments give a larger number of comparisons and a larger number of individual row yields, which permit a more reliable interpretation of the data.

COMPARISON OF TWO PLANTS EVERY 12 INCHES WITH ROWS LEFT UNTHINNED

One experiment was a comparison of unthinned rows with rows in which two plants were left every 12 inches or as near this distance as was possible. An attempt was made to leave two plants in a hill, but because of an uneven stand this was not possible, as the plant count will show. A number of plants in the thinned rows died after the thinning had been done, which further reduced the accuracy of the spacing.

A daily flower count on the two inside rows of each spacing for a period of over two weeks revealed no consistent difference in the number of flowers produced on any day or for any period during the time the counts were made. The rather poor stand in the unthinned rows may account partially for this behavior. (Table 12.)

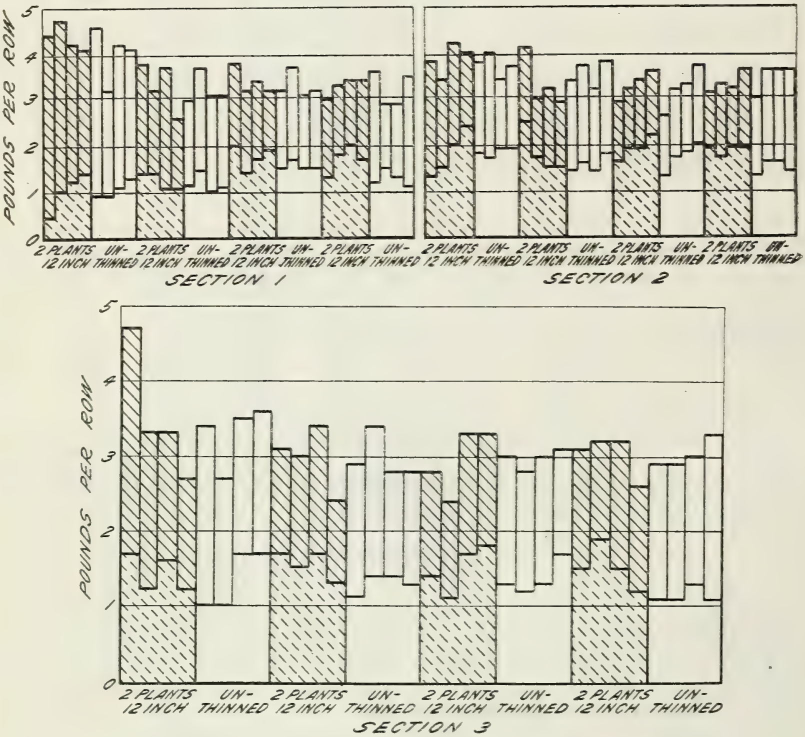

FIG. 12.—Yields (in pounds) of seed cotton per row from comparison of two plants every 12 inches with unthinned rows, Greenville, Tex., 1924

Out of the 21 comparisons of the sum of the two inside rows, 1 is equal, 9 are in favor of the unthinned blocks, and 11 are in favor of two plants every 12 inches. In most cases the increase in yield of one spacing over the other is very slight. The mean difference in yield between the two inside rows of each spacing was 0.1 ± 0.076 pound, which is not significant, and both spacings may be regarded as yielding equally well. From Figure 12, in which the yields are shown graphically, no consistent difference is apparent between the two spacings.

There was a decided tendency in this experiment for the two plants every 12 inches to produce more cotton in the first picking than the unthinned rows, the latter yielding about 47 per cent and the rows with two plants every 12 inches about 53 per cent of the crop in the first picking.

Table 12.—*Comparative yields in cotton-spacing experiment with two plants every 12 inches and unthinned rows, Greenville, Tex., 1924*

[The rows, which were 100 feet long, were planted Apr. 23 and thinned June 13 (when the plants were about 5½ inches high and bearing about nine true leaves). The first picking was Sept. 26 and the second one Oct. 15]

Spacing	Row No.	Section 1				Section 2				Section 3			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total		First picking	Second picking	Total
Two plants every 12 inches (block 1)	1	134	0.4	4.0	4.4	193	1.3	2.5	3.8	192	1.7	3.0	4.7
	2	184	1.0	3.7	4.7	167	1.5	1.9	3.4	200	1.2	2.1	3.3
	3	145	1.2	3.0	4.2	184	2.0	2.2	4.2	202	1.6	1.7	3.3
	4	158	1.4	2.7	4.1	167	3.4	1.6	4.0	152	1.2	1.5	2.7
Total	----	621	4.0	13.4	17.4	711	7.2	8.2	15.4	746	5.7	8.3	14.0
Unthinned (block 2)	1	347	.9	3.7	4.6	307	1.8	2.0	3.8	320	1.0	2.4	3.4
	2	284	.9	2.3	3.2	294	1.7	2.3	4.0	311	1.0	1.7	2.7
	3	322	1.1	3.1	4.2	328	1.9	1.5	3.4	279	1.7	1.8	3.5
	4	299	1.3	2.8	4.1	374	1.9	1.8	3.7	359	1.7	1.9	3.6
Total	----	1,252	4.2	11.9	16.1	1,303	7.3	7.6	14.9	1,269	5.4	7.8	13.2
Two plants every 12 inches (block 3)	1	188	1.4	2,4	3.8	199	2.5	1.6	4.1	209	1.7	1.4	3.1
	2	139	1.4	1.8	3.2	184	1.7	1.8	3.5	209	1.5	1.5	3.0
	3	189	1.1	2.6	3.7	192	1.5	2.2	3.7	231	1.7	1.7	3.4
	4	155	1.1	1.5	2.6	188	1.5	1.9	3.4	195	1.3	1.1	2.4
Total	----	671	5.0	8.3	13.3	763	7.2	7.5	14.7	844	6.2	5.7	11.9
Unthinned (block 4)	1	256	1.2	1.8	3.0	328	1.4	2.0	3.4	317	1.1	1.8	2.9
	2	401	1.5	2.2	3.7	434	1.6	2.1	3.7	397	1.4	2.0	3.4
	3	279	1.0	2.1	3.1	302	1.4	1.8	3.2	358	1.4	1.4	2.8
	4	298	1.1	2.0	3.1	337	1.8	2.0	3.8	394	1.3	1.5	2.8
Total	----	1,234	4.8	8.1	12.9	1,401	6.2	7.9	14.1	1,466	5.2	6.7	11.9
Two plants every 12 inches (block 5)	1	190	2.0	1.8	3.8	198	1.6	1.3	2.9	216	1.4	1.4	2.8
	2	170	1.4	1.8	3.2	192	1.9	1.3	3.2	215	1.1	1.3	2.4
	3	193	1.7	1.7	3.4	216	1.9	1.5	3.4	239	1.7	1.6	3.3
	4	180	1.9	1.3	3.2	204	2.2	1.4	3.6	215	1.8	1.5	3.3
Total	----	733	7.0	6.6	13.6	810	7.6	5.5	13.1	885	6.0	5.8	11.8
Unthinned (block 6)	1	290	1.5	1.7	3.2	282	1.3	1.3	2.6	316	1.3	1.7	3.0
	2	326	1.7	2.0	3.7	279	1.7	1.5	3.2	320	1.2	1.6	2.8
	3	366	1.5	1.6	3.1	307	1.8	1.5	3.3	320	1.3	1.7	3.0
	4	252	1.5	1.7	3.2	327	2.0	1.7	3.7	317	1.7	1.4	3.1
Total	----	1,234	6.2	7.0	13.2	1,195	6.8	6.0	12.8	1,273	5.5	6.4	11.9
Two plants every 12 inches (block 7)	1	192	1.3	1.7	3.0	200	1.9	1.2	3.1	231	1.5	1.6	3.1
	2	205	1.8	1.5	3.3	188	1.9	1.4	3.3	217	1.9	1.3	3.2
	3	186	2.0	1.4	3.4	195	1.7	1.5	3.2	217	1.5	1.7	3.2
	4	192	1.7	1.7	3.4	206	1.9	1.7	3.6	223	1.2	1.4	2.6
Total	----	775	6.8	6.3	13.1	780	7.4	5.8	13.2	888	6.1	6.0	12.1
Unthinned (block 8)	1	453	1.2	2.4	3.6	405	1.3	1.7	3.0	322	1.1	1.8	2.9
	2	325	1.5	1.4	2.9	346	1.6	2.0	3.6	422	1.1	1.8	2.9
	3	332	1.3	1.6	2.9	334	1.6	2.0	3.6	342	1.3	1.7	3.0
	4	362	1.1	2.4	3.5	342	1.4	2.2	3.6	365	1.1	2.2	3.3
Total	----	1,472	5.1	7.8	12.9	1,427	5.9	7.9	13.8	1,451	4.6	7.5	12.1

COMPARISON OF CHOPPED AND UNTHINNED ROWS AT CAMPBELL, TEX.

In 1924 another test comparing chopped rows with unthinned rows was made on a farm near Campbell. The choppers were instructed to chop out the rows, leaving one or two plants in hills about 12 inches apart. The experiment was exposed to a heavy infestation of grasshoppers after thinning, causing the loss of a great many terminal buds, which may be partly responsible for the wide variations in row yields. (Fig. 13 and Table 13.)

Section 1 shows considerable variation in block yields as well as in row yields. There is a gradual increase in yields from successive blocks of the same spacing across the first section. Sections 2 and 3 do not show this condition but do show some wide differences in row yields from the same block. In 15 out of 18 block comparisons of inside rows the unthinned blocks gave the highest yields. The mean difference in yield from the two inside rows of each block of the two spacings is 0.628 ± 0.144 pound, which is 4.4 times the probable error of the difference and may be regarded as significant. The mean difference corresponds to an increase of 9.1 per cent in the unthinned rows, whereas the difference between the mean yields is 0.6 pound, corresponding to an increase of about 8.8 per cent.

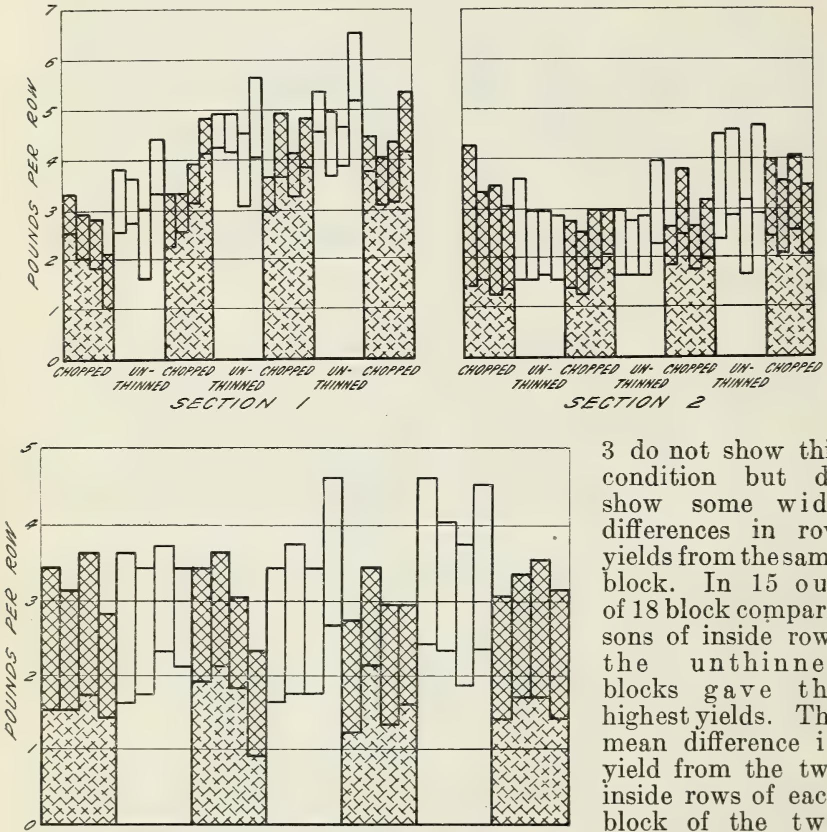

FIG. 13.—Yields (in pounds) of seed cotton per row from comparison of chopped and unthinned rows, Campbell, Tex., 1924

There was little difference in the rate of maturity between the two spacings. Each spacing had opened about 60 per cent of its crop on the date of first picking.

TABLE 13.—*Comparative yields in cotton-spacing experiment with chopped and unthinned rows, Campbell, Tex., 1924*

[The rows, which were 75 feet long, were planted May 5 and chopped June 12 (when the plants were from 4 to 6 inches high and were bearing about four to six true leaves). The first picking was Sept. 10 and the second one Oct. 16]

Spacing	Row No.	Section 1				Section 2				Section 3			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total		First picking	Second picking	Total
Chopped (block 1)	1	102	2.5	0.8	3.3	107	1.4	2.8	4.2	93	1.5	1.9	3.4
	2	93	2.0	.9	2.9	74	1.5	1.8	3.3	67	1.5	1.6	3.1
	3	76	1.8	1.0	2.8	64	1.2	2.2	3.4	74	1.7	1.9	3.6
	4	74	1.0	1.1	2.1	76	1.3	1.7	3.0	75	1.4	1.4	2.8
Total	----	345	7.3	3.8	11.1	321	5.4	8.5	13.9	309	6.1	6.8	12.9
Unthinned (block 2)	1	230	2.5	1.3	3.8	173	1.6	2.0	3.6	113	1.6	2.0	3.6
	2	187	2.7	.9	3.6	172	1.5	1.4	2.9	170	1.7	1.7	3.4
	3	140	1.6	1.4	3.0	175	1.6	1.3	2.9	193	2.3	1.4	3.7
	4	174	3.3	1.1	4.4	155	1.6	1.3	2.9	170	2.1	1.3	3.4
Total	----	731	10.1	4.7	14.8	675	6.3	6.0	12.3	646	7.7	6.4	14.1
Chopped (block 3)	1	102	2.2	1.1	3.3	98	1.3	1.4	2.7	82	1.9	1.5	3.4
	2	73	2.5	.8	3.3	70	1.2	1.3	2.5	68	2.1	1.5	3.6
	3	93	3.1	.8	3.9	94	1.7	1.2	2.9	64	1.8	1.2	3.0
	4	101	4.1	.7	4.8	80	2.0	.9	2.9	60	.9	1.4	2.3
Total	----	369	11.9	3.4	15.3	342	6.2	4.8	11.0	274	6.7	5.6	12.3
Unthinned (block 4)	1	214	4.2	.7	4.9	183	1.6	1.3	2.9	185	1.6	1.8	3.4
	2	238	4.1	.8	4.9	199	1.6	1.1	2.7	239	1.7	2.0	3.7
	3	161	3.0	1.5	4.5	161	1.6	1.2	2.8	168	1.7	1.7	3.4
	4	219	4.0	1.6	5.6	195	2.2	1.7	3.9	216	2.6	2.0	4.6
Total	----	832	15.3	4.6	19.9	738	7.0	5.3	12.3	808	7.6	7.5	15.1
Chopped (block 5)	1	69	2.9	.7	3.6	74	1.8	.8	2.6	58	1.2	1.5	2.7
	2	106	3.6	1.3	4.9	90	2.4	1.3	3.7	54	2.1	1.3	3.4
	3	74	3.2	.9	4.1	74	1.7	.9	2.6	48	1.3	1.6	2.9
	4	116	3.8	1.0	4.8	91	1.9	1.2	3.1	58	1.6	1.3	2.9
Total	----	365	13.5	3.9	17.4	329	7.8	4.2	12.0	218	6.2	5.7	11.9
Unthinned (block 6)	1	186	4.5	.8	5.3	181	2.3	2.1	4.4	174	2.4	2.2	4.6
	2	151	3.6	1.3	4.9	192	2.8	1.7	4.5	172	2.3	1.7	4.0
	3	117	4.8	.8	5.6	111	1.6	1.5	3.1	121	1.8	1.9	3.7
	4	188	5.1	1.4	6.5	121	2.8	1.8	4.6	171	2.3	2.2	4.5
Total	----	642	18.0	4.3	22.3	605	9.5	7.1	16.6	638	8.8	8.0	16.8
Chopped (block 7)	1	62	3.7	.7	4.4	62	2.4	1.5	3.9	59	1.4	1.6	3.0
	2	61	3.0	1.0	4.0	59	2.0	1.5	3.5	65	1.7	1.6	3.3
	3	69	3.1	1.2	4.3	73	2.5	1.5	4.0	56	1.7	1.8	3.5
	4	89	4.1	1.2	5.3	67	2.0	1.4	3.4	48	1.4	1.7	3.1
Total	----	281	13.9	4.1	18.0	261	8.9	5.9	14.8	228	6.2	6.7	12.9

SPACING EXPERIMENTS IN 1925

The summer of 1925 was probably the driest during the 5-year period covered by this report. In addition to the dry summer weather there was undoubtedly less stored moisture in the soil than during any of the years from 1921 to 1925, inclusive.

The five spacing experiments made in 1925 include the following comparisons:

Comparison of one plant every 12 inches with unthinned rows.
Comparison of one plant every 12 inches with two plants every 12 inches.
Comparison of one plant every 12 inches with three plants in hills 12 inches apart.
Comparison of one plant every 12 inches with rows blocked out with an 8-inch hoe.
Comparison of blocked-out rows with unthinned rows.

Each experiment was limited to a comparison of two spacings arranged in alternating 4-row blocks triplicated. The plantings in this series of experiments were made April 13 at the rate of 45 pounds of seed to the acre. The usual rate of planting is 25 to 30 pounds of seed, but some difficulty in obtaining good stands had been experienced in former years, and this unusually heavy rate of planting was made to insure a more uniform stand of plants. Also, since unthinned rows, or the original stand from plantings of 25 to 30 pounds to the acre, had shown a tendency to produce more cotton than thinned rows, it appeared desirable to plant more seed to the acre and to study the behavior of the plants under still closer spacings.

COMPARISON OF ONE PLANT EVERY 12 INCHES WITH UNTHINNED ROWS

In the first experiment one plant every 12 inches was compared with unthinned rows. (Table 14.) This test affords 15 side-by-side comparisons, and in every case the two inside rows of the unthinned blocks produced more cotton than the two inside rows of the adjoining blocks, which were thinned to one plant every 12 inches.

TABLE 14.—*Comparative yields in cotton-spacing experiment with unthinned rows and 12-inch spacing, Greenville, Tex., 1925*

[The rows, which were 100 feet long, were planted Apr. 13, and thinned June 1 (when the plants were about 5½ inches high and were bearing about seven true leaves). The first picking was Sept. 4 and the second one Oct. 8]

Spacing	Row No.	Section 1				Section 2				Section 3			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total		First picking	Second picking	Total
Unthinned (block 1)	1	471	1.7	1.7	3.4	512	2.4	0.9	3.3	432	2.3	0.6	2.9
	2	515	2.0	1.8	3.8	413	2.3	.6	2.9	459	2.5	.6	3.1
	3	515	2.5	1.7	4.2	466	2.3	.9	3.2	437	2.8	.7	3.5
	4	538	1.8	2.4	4.2	504	2.3	1.3	3.6	451	2.1	.9	3.0
Total	----	2,039	8.0	7.6	15.6	1,895	9.3	3.7	13.0	1,779	9.7	2.8	12.5
One plant every 12 inches (block 2)	1	101	1.8	1.6	3.4	98	1.8	.6	2.4	101	1.9	.6	2.5
	2	98	1.7	1.9	3.6	100	2.0	.7	2.7	97	2.2	.7	2.9
	3	99	1.9	1.7	3.6	99	1.8	.6	2.4	98	2.1	.6	2.7
	4	100	2.0	1.2	3.2	101	1.8	.4	2.2	106	1.8	.5	2.3
Total	----	398	7.4	6.4	13.8	398	7.4	2.3	9.7	402	8.0	2.4	10.4
Unthinned (block 3)	1	644	2.3	2.3	4.6	460	3.0	.8	3.8	508	2.5	.7	3.2
	2	579	1.9	2.0	3.9	468	2.5	.8	3.3	539	2.7	.7	3.4
	3	559	2.2	1.7	3.9	542	2.5	.6	3.1	549	2.6	.6	3.2
	4	560	1.6	2.1	3.7	488	2.6	.8	3.4	507	2.5	.8	3.3
Total	----	2,342	8.0	8.1	16.1	1,958	10.6	3.0	13.6	2,103	10.3	2.8	13.1
One plant every 12 inches (block 4)	1	100	1.2	1.3	2.5	101	1.6	.6	2.2	107	1.9	.5	2.4
	1	98	1.0	1.4	2.4	103	1.6	.7	2.3	103	1.9	.8	2.7
	3	101	1.5	1.5	3.0	103	1.7	.8	2.5	104	1.8	.8	2.6
	4	101	1.6	1.2	2.8	101	1.6	.7	2.3	101	2.1	.7	2.8
Total	----	400	5.3	5.4	10.7	408	6.5	2.8	9.3	415	7.7	2.8	10.5
Unthinned (block 5)	1	562	2.2	1.7	3.9	413	2.6	1.0	3.6	541	2.3	.8	3.1
	2	542	2.7	1.0	3.7	514	2.4	.6	3.0	610	3.0	.7	3.7
	3	521	2.6	.9	3.5	525	2.1	.7	2.8	532	2.6	.7	3.3
	4	479	2.5	.9	3.4	440	2.3	.9	3.2	570	2.4	.9	3.3
Total	----	2,104	10.0	4.5	14.5	1,892	9.4	3.2	12.6	2,253	10.3	3.1	13.4
One plant every 12 inches (block 6)	1	99	1.4	.6	2.0	98	1.7	.5	2.2	99	1.5	.6	2.1
	2	100	2.2	.8	3.0	104	2.0	.7	2.7	102	1.7	1.0	2.7
	3	101	2.2	.8	3.0	102	2.0	.9	2.9	102	1.5	1.0	2.5
	4	102	2.4	.9	3.3	99	1.8	.7	2.5	99	1.6	1.3	2.9
Total	----	402	8.2	3.1	11.3	403	7.5	2.8	10.3	402	6.3	3.9	10.2

Comparing the yields from the two inside rows of each block in the different spacings, there is a mean difference of 1.24 ± 0.097 in favor of the unthinned rows. This difference is 12.7 times its probable error, which is decidedly significant. The mean difference corresponds to an increase of 22.2 per cent in the unthinned rows, whereas the difference between the mean yields is 1.25 pounds, corresponding to an increase of about 22.4 per cent.

Comparing adjacent outside and inside rows of the same blocks, the frequent higher yield of the outside rows of the unthinned blocks and the lower yields of the outside rows of the thinned blocks show that the unthinned rows are more efficient producers of cotton under very dry conditions. The row yields in pounds of seed cotton are shown graphically in Figure 14.

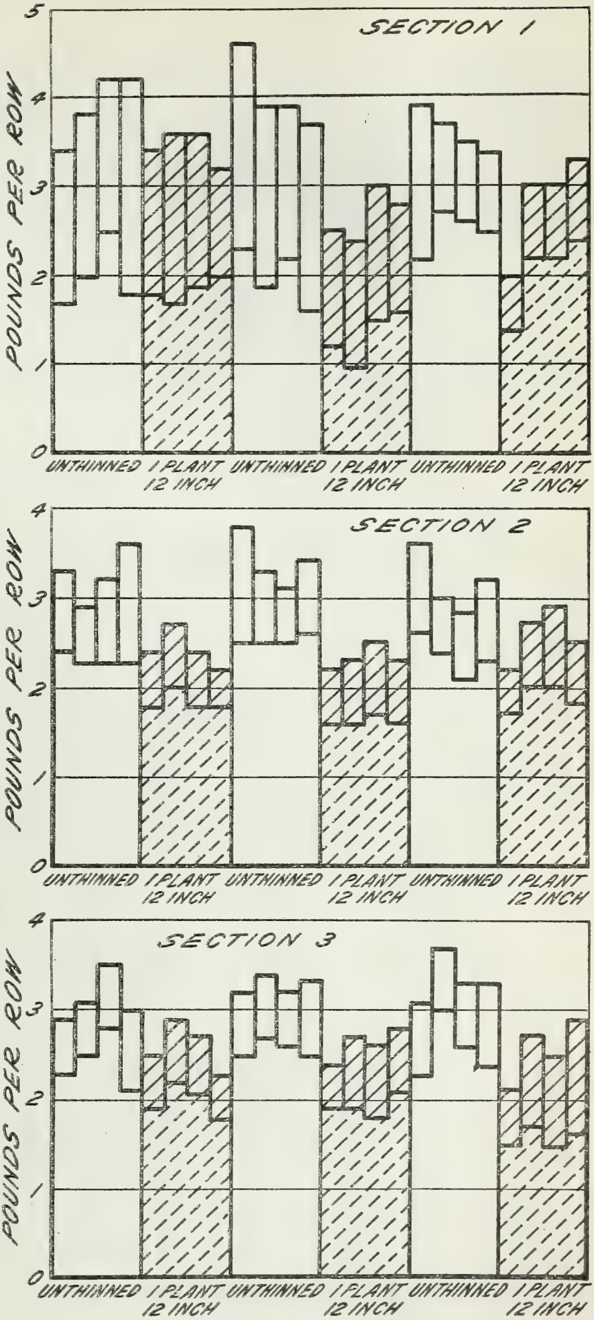

FIG. 14.—Yields (in pounds) of seed cotton per row from comparison of one plant every 12 inches with unthinned rows, Greenville, Tex., 1925

COMPARISON OF ONE PLANT EVERY 12 INCHES WITH TWO PLANTS EVERY 12 INCHES

One plant every 12 inches was compared with two plants every 12 inches. (Table 15.) In 14 out of 15 side-by-side comparisons, two plants every 12 inches produced more cotton than one plant every 12 inches. The single exception in which the block with one plant every 12 inches outyielded two plants every 12 inches was by the slight margin of 0.1 pound. The higher yields from the closer spacing are indicated in Figure 15, which shows graphically the row yields for the two spacings.

TABLE 15.—*Comparative yields in cotton-spacing experiment with single plants 12 inches apart and two plants 12 inches apart, Greenville, Tex., 1925*

[The rows, which were 100 feet long, were planted Apr. 13 and thinned June 1 (when the plants were about 5½ inches high and were bearing about seven true leaves). The first picking was Sept. 4 and the second one Oct. 17]

Spacing	Row No.	Section 1				Section 2				Section 3			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total		First picking	Second picking	Total
Two plants every 12 inches (block 1)	1	198	2.1	1.1	3.2	195	2.0	1.0	3.0	195	2.0	1.6	3.6
	2	204	2.4	1.1	3.5	193	2.0	1.0	3.0	205	1.9	1.5	3.4
	3	204	2.1	1.1	3.2	187	2.4	.8	3.2	201	2.1	1.3	3.4
	4	204	2.3	1.0	3.3	205	2.1	.9	3.0	195	2.2	1.4	3.6
Total	----	810	8.9	4.3	13.2	780	8.5	3.7	12.2	796	8.2	5.8	14.0
One plant every 12 inches (block 2)	1	102	1.7	.8	2.5	101	1.8	.8	2.6	102	1.8	1.0	2.8
	2	101	1.6	1.2	2.8	100	1.8	.9	2.7	101	1.5	1.2	2.7
	3	99	1.6	1.0	2.6	99	1.9	.9	2.8	103	1.4	1.4	2.8
	4	100	1.8	1.1	2.9	101	2.1	1.1	3.2	102	1.7	1.3	3.0
Total	----	402	6.7	4.1	10.8	401	7.6	3.7	11.3	408	6.4	4.9	11.3
Two plants every 12 inches (block 3)	1	189	1.8	1.5	3.3	193	2.1	1.1	3.2	196	2.0	1.3	3.3
	2	198	2.0	1.2	3.2	194	2.2	1.0	3.2	202	1.9	1.6	3.5
	3	195	1.4	1.1	2.5	194	2.2	1.0	3.2	199	2.4	1.1	3.5
	4	203	1.6	1.4	3.0	185	2.1	1.2	3.3	196	2.1	1.0	3.1
Total	----	785	6.8	5.2	12.0	766	8.6	4.3	12.9	793	8.4	5.0	13.4
One plant every 12 inches (block 4)	1	95	1.1	1.0	2.1	96	1.8	.9	2.7	100	1.7	.9	2.6
	2	103	1.5	1.1	2.6	103	1.9	.8	2.7	102	1.9	1.0	2.9
	3	98	1.8	1.0	2.8	104	1.9	.8	2.7	102	1.8	1.2	3.0
	4	101	1.3	1.2	2.5	105	2.0	.9	2.9	98	2.1	1.0	3.1
Total	----	397	5.7	4.3	10.0	408	7.6	3.4	11.0	402	7.5	4.1	11.6
Two plants every 12 inches (block 5)	1	195	1.8	1.4	3.2	186	2.1	1.0	3.1	184	3.0	1.2	4.2
	2	191	1.6	1.3	2.9	196	2.2	1.0	3.2	188	2.3	1.1	3.4
	3	204	1.5	1.1	2.6	205	2.4	.8	3.2	196	2.5	1.1	3.6
	4	202	1.8	1.4	3.2	186	2.3	1.0	3.3	188	2.6	1.2	3.8
Total	----	792	6.7	5.2	11.9	773	9.0	3.8	12.8	756	10.4	4.6	15.0
One plant every 12 inches (block 6)	1	100	1.7	1.0	2.7	101	1.7	.7	2.4	103	2.3	.9	3.2
	2	97	1.9	1.0	2.9	100	2.0	.7	2.7	99	2.4	1.1	3.5
	3	100	1.4	1.0	2.4	103	2.2	.8	3.0	98	2.5	1.1	3.6
	4	99	1.6	.6	2.2	99	2.3	.8	3.1	102	2.1	.7	2.8
Total	----	396	6.6	3.6	10.2	403	8.2	3.0	11.2	402	9.3	3.8	13.1

Comparing yields in pounds of seed cotton from the two inside rows of each block in the different spacings, there is a mean difference of 0.760 ± 0.087 in favor of the rows with two plants every 12 inches. This difference is 8.7 times its probable error and may be regarded as significant. The mean difference corresponds to an increase of 13.4 per cent in the rows with two plants every 12 inches, whereas the difference between the mean yields is 0.72 pound, corresponding to an increase of about 12.7 per cent.

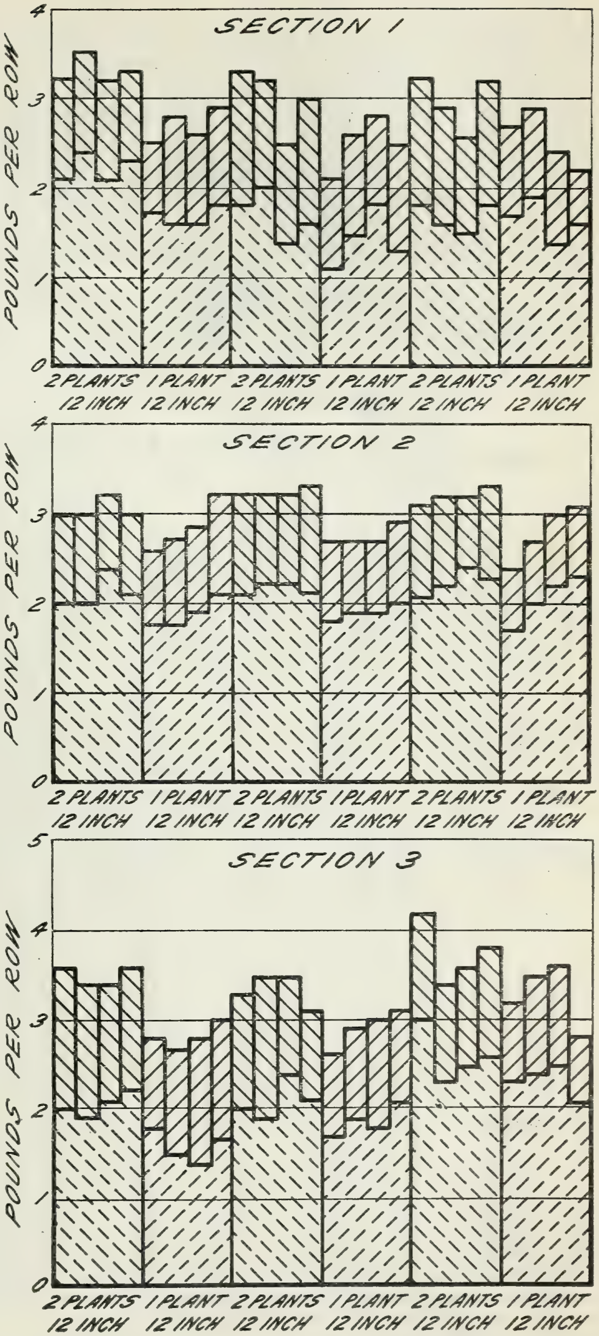

FIG. 15.—Yields (in pounds) of seed cotton per row from comparison of one plant every 12 inches with two plants every 12 inches, Greenville, Tex., 1925

COMPARISON OF ONE PLANT EVERY 12 INCHES WITH THREE PLANTS IN HILLS 12 INCHES APART

An effort was made to compare one plant every 12 inches with three plants in hills 12 inches apart, but the stands of the latter were irregular and many hills had only one or two plants. A plant count shows the mean number of plants per 100-foot row in the row thinned to one plant every 12 inches was 104 as compared with a mean of 270 for the hills with several stalks. Therefore, instead of three stalks to the hill, an average of only 2.7 stalks was obtained. (Table 16.) In 14 out of the 15 comparisons, yields of the two inside rows of the blocks with three plants in hills 12 inches apart gave the higher yields. The single comparison in which 3 plants in hills 12 inches apart did not produce more cotton than the wider spacing was where the yield of both spacings was the same.

TABLE 16.—*Comparative yields in cotton-spacing experiment with three plants in hills 12 inches apart and single plants 12 inches apart, Greenville, Tex., 1925*

[The rows, which were 100 feet long, were planted Apr. 13 and thinned June 1 (when the plants were about 5½ inches high and were bearing about seven true leaves). The first picking was Sept. 4 and the second one Oct. 17]

Spacing	Row No.	Section 1				Section 2				Section 3			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Seccnd picking	Total		First picking	Second picking	Total
Three plants every 12 inches (block 1)	1	230	1.8	1.0	2.8	228	2.2	0.6	2.8	233	1.8	0.8	2.6
	2	254	2.4	.7	3.1	284	1.9	1.1	3.0	265	2.2	.8	3.0
	3	271	2.4	.8	3.2	278	2.5	.9	3.4	274	2.3	.9	3.2
	4	262	2.2	1.0	3.2	281	2.0	1.3	3,3	273	2.5	1.3	3.8
Total	----	1,017	8.8	3.5	12.3	1,071	8.6	3.9	12.5	1,045	8.8	3.8	12.6
One plant every 12 inches (block 2)	1	107	1.4	.9	2.3	98	1.7	.9	2.6	99	1.9	.8	2.7
	2	105	1.7	.7	2.4	98	2.0	1.0	3.0	107	2.1	1.0	3.1
	3	109	2.1	.7	2.8	104	2.0	1.1	3.1	103	1.8	.7	2.5
	4	108	2.0	.7	2.7	103	2.2	1.0	3.2	101	1.8	.7	2.5
Total	----	429	7.2	3.0	10.2	403	7.9	4.0	11.9	410	7.6	3.2	10.8
Three plants every 12 inches (block 3)	1	236	2.9	1.1	4.0	225	2.2	.8	3.0	249	2.2	1.2	3.4
	2	274	2.6	1.0	3.6	276	2.0	.8	2.8	285	2.2	1.0	3.2
	3	281	2.1	1.2	3.3	275	2.5	.8	3.3	295	2.1	1.1	3.2
	4	252	2.5	1.0	3.5	310	2.4	1.1	3.5	268	2.2	1.2	3.4
Total	----	1,043	10.1	4.3	14.4	1,086	9.1	3.5	12.6	1,096	8.7	4.5	13.2
One plant every 12 inches (block 4)	1	110	1.8	.8	2.6	98	1.2	.7	1.9	101	1.5	.8	2.3
	2	110	1.8	.9	2.7	103	1.8	.9	2.7	103	1.8	1.0	2.8
	3	112	2.2	.9	3.1	104	1.8	.9	2.7	99	2.1	1.0	3.1
	4	108	2.0	.8	2.8	105	1.9	1.1	3.0	104	2.2	.8	3.0
Total	----	440	7.8	3.4	11.2	410	6.7	3.6	10.3	407	7.6	3.6	11.2
Three plants every 12 inches (block 5)	1	277	2.4	.9	3.3	242	2.1	1.3	3.4	250	2.3	1.0	3.3
	2	275	2.4	.8	3.2	282	2.6	1.1	3.7	308	2.7	.8	3.5
	3	280	2.6	.9	3.5	291	3.1	1.0	4.1	332	2.7	1.1	3.8
	4	265	2.7	1.3	4.0	291	2.2	1.4	3.6	293	3.1	1.0	4.1
Total	----	1,097	10.1	3.9	14.0	1,106	10.0	4.8	14.8	1,183	10.8	3.9	14.7
One plant every 12 inches (block 6)	1	110	2.2	.7	2.9	104	1.7	1.2	2.9	100	1.9	.8	2.7
	2	111	2.1	.9	3.0	104	1.7	.9	2.6	102	1.8	.9	2.7
	3	112	1.8	.8	2.6	102	1.7	.9	2.6	99	1.9	1.0	2.9
	4	110	1.7	.8	2.5	106	1.6	.8	2.4	101	1.6	1.2	2.8
Total	----	443	7.8	3.2	11.0	416	6.7	3.8	10.5	402	7.2	3.9	11.1

Comparing the yields from the two inside rows of each block of the different spacings, there is a mean difference of 1.126±0.130 pounds in favor of the spacing with three plants in hills 12 inches apart. This difference is 8.65 times its probable error. The mean difference corresponds to an increase of 20.1 per cent in the spacing with three plants in hills 12 inches apart, whereas the difference between the mean yields is 1.08 pounds, corresponding to an increase of about 19.3 per cent. These two spacings differ widely in yield, and there appears to be considerable robbing by the hill plantings of the outside rows of the blocks with one plant every 12 inches. The actual difference, however, is slight, and a comparison of mean row yields from inside rows with the mean yield of inside and outside rows shows that the plants in hills produced a larger crop with no serious detrimental effect on the adjoining rows with wider spa[illegible]d plants. This also indicates that several stalks in a hill are more efficient producers of cotton under very dry conditions than single

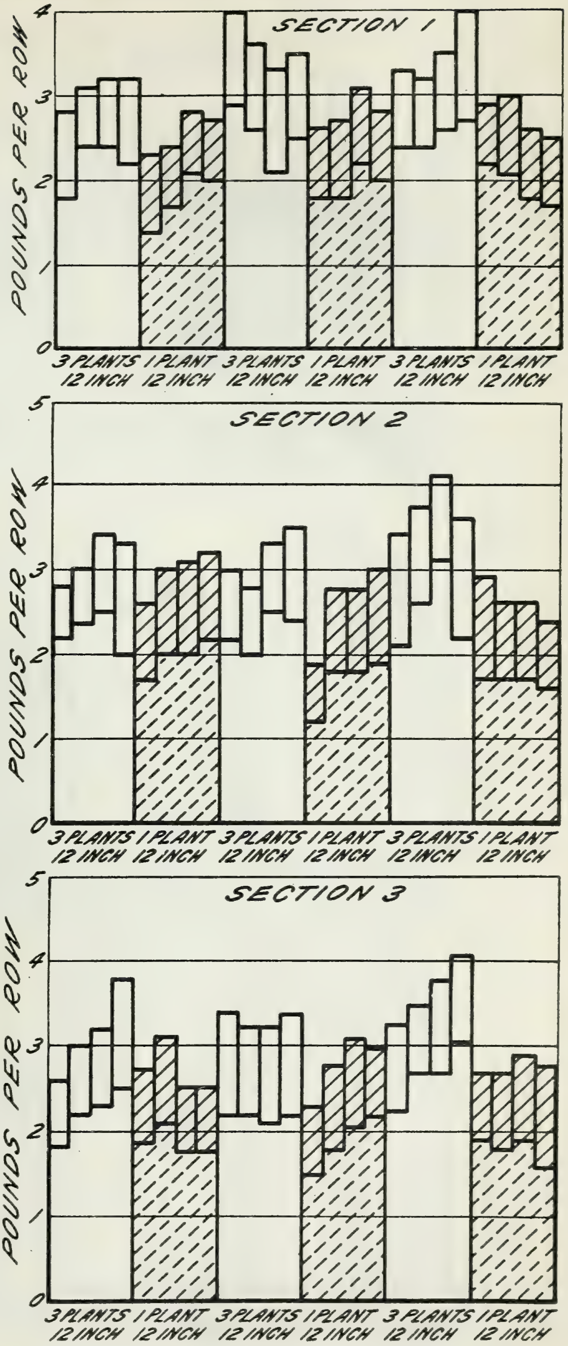

FIG. 16.—Yields (in pounds) of seed cotton per row from comparison of one plant every 12 inches with three plants in hills 12 inches apart, Greenville, Tex., 1925

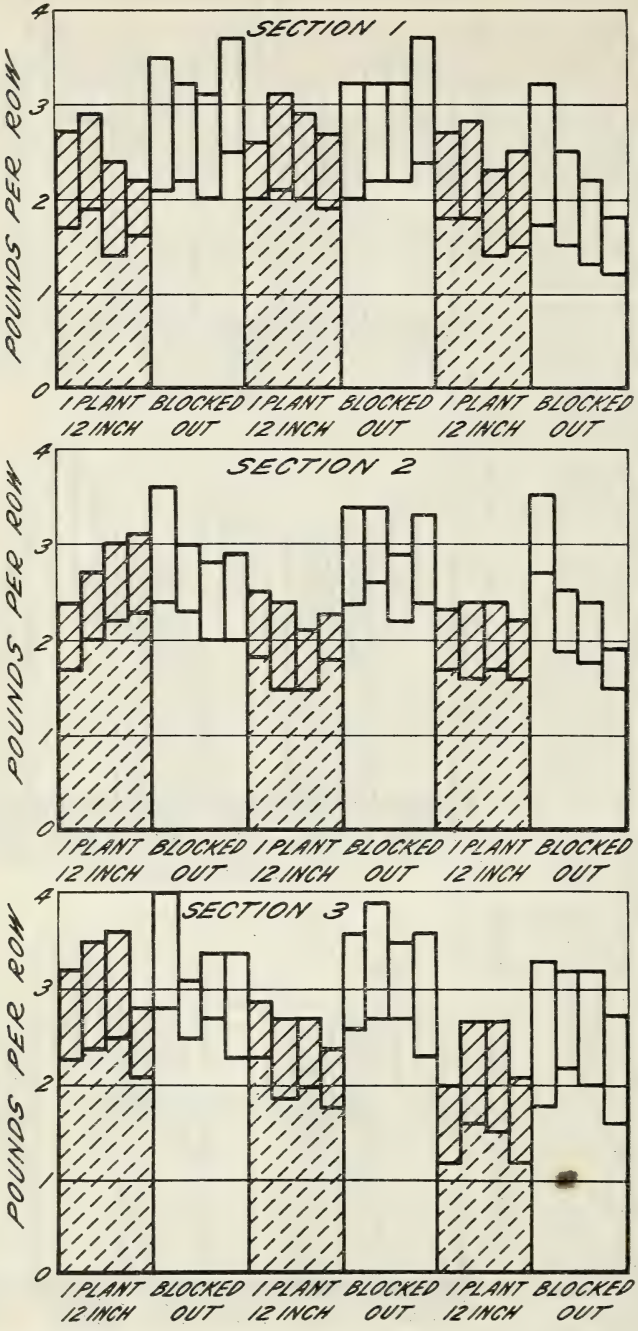

FIG. 17.—Yields (in pounds) of seed cotton per row from comparison of one plant every 12 inches with blocked-out rows, Greenville, Tex., 1925

plants in hills. The row yields and block yields are shown graphically in Figure 16.

COMPARISON OF ONE PLANT EVERY 12 INCHES WITH BLOCKED-OUT ROWS

A comparison was made of rows with one plant every 12 inches and rows blocked out with an 8-inch hoe, leaving the plants in clumps a hoe's width apart. About half of the plants were chopped out of the blocked-out rows (Table 17). In 13 out of 15 comparisons of the two inside rows of each block, the blocked-out rows gave higher yields. Comparing the yields in pounds of seed cotton from the inside rows of the blocks of each spacing, there is a mean difference of 0.860 ± 0.148 pound in favor of the blocked-out rows. The mean difference corresponds to an increase of 15.7 per cent in the blocked-out rows, whereas the difference between the mean yields is 0.6 pound, corresponding to an increase of about 10.9 per cent.

TABLE 17.—*Comparative yields in cotton-spacing experiment with single plants every 12 inches and blocked-out rows, Greenville, Tex., 1925*

[The rows, which were 100 feet long, were planted Apr. 13 and thinned June 1 (when the plants were about 5½ inches high and were bearing about seven true leaves). The first picking was Sept. 4 and the second one Oct. 17]

Spacing	Row No.	Section 1				Section 2				Section 3			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total		First picking	Second picking	Total
One plant every 12 inches (block 1)	1	100	1.7	1.0	2.7	101	1.7	0.7	2.4	103	2.3	0.9	3.2
	2	97	1.9	1.0	2.9	100	2.0	.7	2.7	99	2.4	1.1	3.5
	3	100	1.4	1.0	2.4	103	2.2	.8	3.0	98	2.5	1.1	3.6
	4	99	1.6	.6	2.2	99	2.3	.8	3.1	102	2.1	.7	2.8
Total		396	6.6	3.6	10.2	403	8.2	3.0	11.2	402	9.3	3.8	13.1
Blocked out (block 2)	1	298	2.1	1.4	3.5	282	2.4	1.2	3.6	321	2.8	.7	3.5
	2	325	2.2	1.0	3.2	337	2.3	.7	3.0	307	2.5	.6	3.1
	3	277	2.0	1.1	3.1	320	2.0	.8	2.8	321	2.7	.7	3.4
	4	364	2.5	1.2	3.7	312	2.0	.9	2.9	361	2.3	1.1	3.4
Total		1,264	8.8	4.7	13.5	1,251	8.7	3.6	12.3	1,310	10.3	3.1	13.4
One plant every 12 inches (block 3)	1	104	2.0	.6	2.6	100	1.8	.7	2.5	92	2.3	.6	2.9
	2	100	2.1	1.0	3.1	100	1.5	.9	2.4	104	1.9	.8	2.7
	3	101	2.0	.9	2.9	107	1.5	.6	2.1	98	2.0	.7	2.7
	4	101	1.9	.8	2.7	99	1.8	.5	2.3	103	1.8	.6	2.4
Total		406	8.0	3.3	11.3	406	6.6	2.7	9.3	397	8.0	2.7	10.7
Blocked out (block 4)	1	340	2.0	1.2	3.2	326	2.4	1.0	3.4	315	2.6	1.0	3.6
	2	317	2.2	1.0	3.2	299	2.6	.8	3.4	377	2.7	1.2	3.9
	3	331	2.2	1.0	3.2	279	2.2	.7	2.9	331	2.7	.8	3.5
	4	314	2.4	1.3	3.7	303	2.4	.9	3.3	323	2.3	1.3	3.6
Total		1,302	8.8	4.5	13.3	1,207	9.6	3.4	13.0	1,346	10.3	4.3	14.6
One plant every 12 inches (block 5)	1	103	1.8	.9	2.7	100	1.7	.6	2.3	102	1.2	.8	2.0
	2	99	1.8	1.0	2.8	101	1.6	.8	2.4	102	1.6	1.1	2.7
	3	103	1.4	.9	2.3	100	1.7	.7	2.4	101	1.5	1.2	2.7
	4	98	1.5	1.0	2.5	99	1.6	.6	2.2	100	1.2	.9	2.1
Total		403	6.5	3.8	10.3	400	6.6	2.7	9.3	405	5.5	4.0	9.5
Blocked out (block 6)	1	374	1.7	1.5	3.2	372	2.7	.8	3.5	312	1.8	1.5	3.3
	2	324	1.5	1.0	2.5	310	1.9	.6	2.5	340	2.2	1.0	3.2
	3	325	1.3	.9	2.2	303	1.8	.6	2.4	365	2.0	1.2	3.2
	4	310	1.2	.6	1.8	348	1.5	.4	1.9	307	1.6	1.1	2.7
Total		1,333	5.7	4.0	9.7	1,333	7.9	2.4	10.3	1,324	7.6	4.8	12.4

The yields from this experiment are also shown graphically in Figure 17. There is wide variation in the row yields, but the more productive nature of the rows with the greater number of plants is very evident.

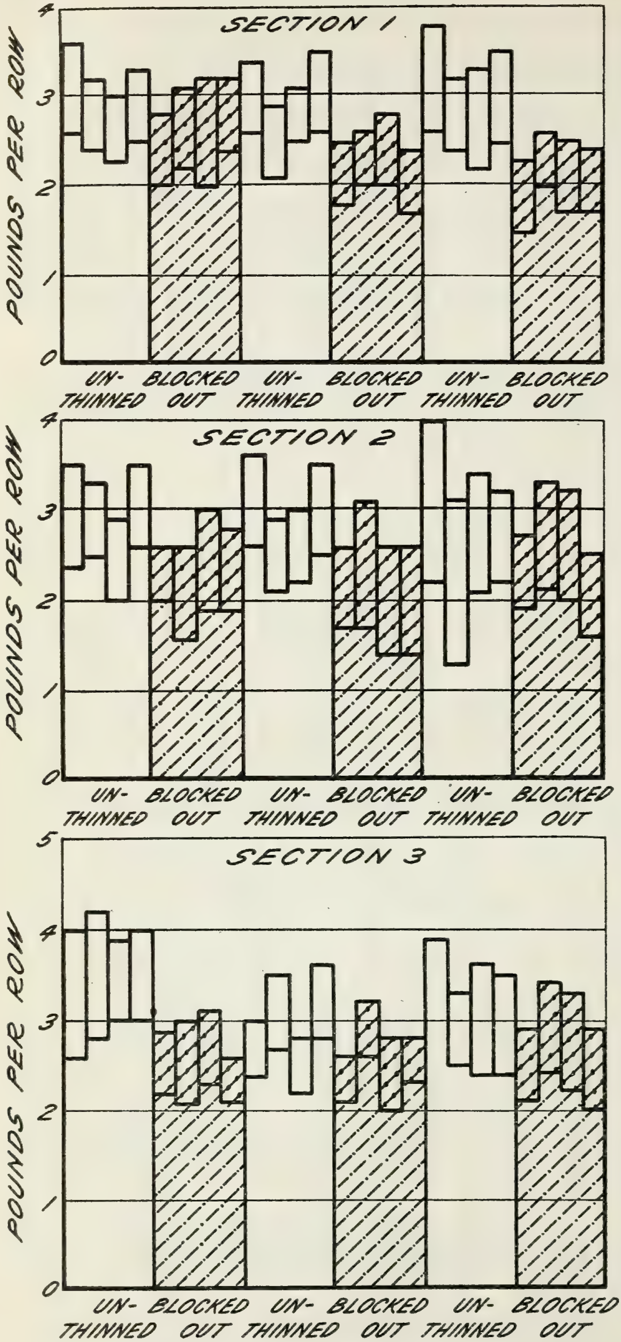

FIG. 18.—Yields (in pounds) of seed cotton per row from comparison of unthinned and blocked-out rows Greenville, Tex., 1925

COMPARISON OF UNTHINNED AND BLOCKED-OUT ROWS

With one exception, the 1925 experiments were comparisons of thinned rows with a closer spacing. The last experiment was a comparison of two close spacings in unthinned and blocked-out rows. The plants in the unthinned rows averaged 2 to 3 inches apart, but in the blocked-out rows they were about 6 inches apart. (Table 18.) In 12 of the 15 comparisons the two inside rows from the unthinned blocks gave the highest yields. In one comparison the yield was equal, and in two cases the blocked-out rows gave higher yields.

Considering yields in pounds of seed cotton from the two inside rows of each block of each spacing, there is a mean difference of 0.546 ±

0.108 pound in favor of the unthinned rows. This difference is more than five times the probable error and may be regarded as significant. The mean difference corresponds to an increase of 9.2 per cent in the unthinned rows, whereas the difference between the mean yields is 0.58 pound, corresponding to an increase of 9.8 per cent.

The row yields are shown graphically in Figure 18 and indicate the superior fruiting of the unthinned rows over the blocked-out rows. In the 1925 experiments the rows with the highest number of plants produced more cotton in every comparison.

Table 18.—*Comparative yields in cotton-spacing experiment with unthinned and blocked-out rows, Greenville, Tex., 1925*

[The rows, which were 100 feet long, were planted Apr. 13 and thinned June 1 (when the plants were about 5½ inches high and were bearing about seven true leaves). The first picking was Sept. 4 and the second one Oct. 17]

Spacing	Row No.	Section 1				Section 2				Section 3			
		Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)			Number of plants	Yield of seed cotton (pounds)		
			First picking	Second picking	Total		First picking	Second picking	Total		First picking	Second picking	Total
Unthinned (block 1)	1	459	2.6	1.0	3.6	496	2.4	1.1	3.5	420	2.6	1.4	4.0
	2	473	2.4	.8	3.2	442	2.5	.8	3.3	500	2.8	1.4	4.2
	3	454	2.3	.7	3.0	454	2.0	.9	2.9	458	3.0	.9	3.9
	4	455	2.5	.8	3.3	512	2.6	.9	3.5	495	3.0	1.0	4.0
Total	----	1,841	9.8	3.3	13.1	1,904	9.5	3.7	13.2	1,873	11.4	4.7	16.1
Blocked (block 2)	1	131	2.0	.9	2.8	230	2.0	.6	2.6	213	2.2	.7	2.9
	2	204	2.2	.8	3.1	214	1.6	1.0	2.6	213	2.1	.9	3.0
	3	211	2.0	1.2	3.2	241	1.9	1.1	3.0	225	2.3	.8	3.1
	4	208	2.4	.8	3.2	216	1.9	.9	2.8	216	2.1	.5	2.6
Total	----	754	8.6	3.7	12.3	901	7.4	3.6	11.0	867	8.7	2.9	11.6
Unthinned (block 3)	1	340	2.6	.8	3.4	500	2.6	1.0	3.6	464	2.4	.6	3.0
	2	492	2.1	.8	2.9	437	2.1	.8	2.9	570	2.7	.8	3.5
	3	471	2.5	.6	3.1	458	2.2	.8	3.0	537	2.2	.6	2.8
	4	428	2.6	.9	3.5	409	2.5	1.0	3.5	528	2.8	.8	3.6
Total	----	1,731	9.8	3.1	12.9	1,804	9.4	3.6	13.0	2,099	10.1	2.8	12.9
Blocked (block 4)	1	229	1.8	.7	2.5	205	1.7	.9	2.6	235	2.1	.5	2.6
	2	214	2.0	.6	2.6	214	1.7	1.4	3.1	224	2.6	.6	3.2
	3	194	2.0	.8	2.8	205	1.4	1.2	2.6	146	2.0	.8	2.8
	4	183	1.7	.7	2.4	162	1.4	1.2	2.6	183	2.3	.5	2.8
Total	----	820	7.5	2.8	10.3	786	6.2	4.7	10.9	788	9.0	2.4	11.4
Unthinned (block 5)	1	425	2.6	1.2	3.8	427	2.2	1.8	4.0	497	3.0	.9	3.9
	2	355	2.4	.8	3.2	407	1.8	1.3	3.1	430	2.5	.8	3.3
	3	517	2.2	1.1	3.3	438	2.1	1.3	3.4	528	2.4	1.2	3.6
	4	453	2.5	1.0	3.5	428	2.2	1.0	3.2	464	2.4	1.1	3.5
Total	----	1,750	9.7	4.1	13.8	1,700	8.3	5.4	13.7	1,919	10.3	4.0	14.3
Blocked (block 6)	1	219	1.5	.8	2.3	201	1.9	.8	2.7	235	2.1	.8	2.9
	2	179	2.0	.6	2.6	241	2.1	1.2	3.3	256	2.4	1.0	3.4
	3	222	1.7	.8	2.5	219	2.0	1.2	3.2	253	2.2	1.1	3.3
	4	211	1.7	.7	2.4	219	1.6	.9	2.5	260	2.0	.9	2.9
Total	----	831	6.9	2.9	9.8	880	7.6	4.1	11.7	1,004	8.7	3.8	12.5

SUMMARY OF YIELDS FROM SPACING EXPERIMENTS

In the results of the 18 experiments conducted during the 5-year period from 1921 to 1925, inclusive, there is an outstanding tendency toward higher yields from rows with plants spaced less than 12 inches apart. In this series of experiments there has been only one in which plants spaced 12 inches apart have produced significantly more cotton than plants spaced less than this distance.

The experiment of 1921, in which only 6-inch and 12-inch spacings were compared, showed a significantly higher yield from the 6-inch spacing.

In 1922 there was no outstanding difference in yield in the comparison of 6-inch and 12-inch spacings with unthinned rows. In one experiment the 12-inch spacing produced more cotton than the closer spacings, but in another comparison of the same spacings the 6-inch yielded slightly more than the 12-inch spacing or the unthinned rows. Cotton planted in hills 21 inches apart gave much higher yields from rows in which several stalks had been left in the hill, as compared with only one plant in a hill.

In 1923 there was a very definite tendency toward higher yields from the 6-inch spacing and the unthinned rows compared with wider spacings. Seven experiments were made in 1923, of which only one showed a tendency toward higher yields from rows in which the plants were spaced 12 inches apart.

Two experiments were made in 1924. One showed significantly higher yields from unthinned rows, as compared with chopped rows. In the second experiment the rows with two plants every 12 inches produced slightly more cotton than the rows that were left unthinned. The difference in this case was not significant and would not pay for the cost of chopping.

Five experiments were made in 1925, and in each one the closer spacing showed a significantly higher yield than the wider spacing with which it was compared. The summer of 1925 was the driest during the 5-year period covered by this report, and the stored moisture in the soil was less in the spring of 1925 than in any year from 1921 to 1925. Higher yields from the closer spacings in 1925 were consistent and significant.

It has often happened that there was little or no difference between the yields of the unthinned rows and the 6-inch spaced rows. The 6-inch spacing is undoubtedly a desirable distance between cotton plants, but is one that is difficult to obtain under field conditions. The general results of these experiments indicate that the yield of cotton is more likely to be reduced than increased by chopping.

The saving of labor or expense is in favor of unthinned cotton. It is recognized, however, that in some districts the cotton requires weeding and that weeding and chopping to a stand are often combined in one operation. Hence, leaving the rows unthinned may not save the entire cost of chopping.

Under the usual conditions at Greenville the yield of cotton appears to be closely associated with the number of plants to the acre. Of course, it is possible for the plants to be overcrowded or for seasons to be so dry that the plants do not reach the fruiting stage. But in short periods of favorable conditions more bolls are set in the close-spaced rows.

The number of plants that can safely be left in the row is a question that must be determined by the grower for his various types of soil and different climatic conditions. These experiments show that much closer stands of plants than are now customary may be left in the rows, with added chances for increased yields. Although close spacing of the plants usually promotes earliness in the crop, in some of the Greenville experiments the thinned rows gave the greatest yields in the first picking. In such cases it may be inferred that the plants in the unthinned rows were too close for the best results under the early-season conditions, but that they obtained a greater advantage from a favorable period later in the season.

Comparing the behavior of different spacings on black land and on fine sandy loam, there appears to be a greater advantage in leaving the plants closely spaced on lighter soils, as the experiments on this type of land have given more outstanding differences in favor of the unthinned rows.

CHOPPING AND ITS RELATION TO YIELDS

Under the usual methods of growing cotton, chopping requires an expenditure of considerable labor and money. As chopping is generally done hurriedly, losses from careless chopping are difficult to avoid, especially where the farms are large and much of the help is hired. Many plants are chopped out which should remain in the field, especially if the stand is uneven.

Chopping too early is often injurious (*1*, *2*, *4*, *5*, *8*).[2] Many farmers begin chopping soon after the seedlings have appeared, even before the first pair of true leaves is well developed. If adverse conditions are encountered later the mortality of young cotton plants may be very high, and many may die of seedling disorders or from insect attacks (*3*).

Repeated experiments have shown no advantage in very early thinning of cotton, but on the contrary increased yields and better stands are possible where the thinning is done at a later period, or not until the plants are 5 or 6 inches high and the danger of plants dying after thinning is not so great (*2*, *4*, *5*). The seedlings grow better if they are left close together in the rows, especially if adverse weather conditions are encountered (*3*). In fact, thinning may be unnecessary where the plants are not too thick in the row, unless the weeds are outgrowing the cotton. As maximum yields are more likely to be obtained from close spacing, chopping should be done with great caution.

To get a more definite check upon the effects of chopping, a simple test was made in a field where the seedlings had come up to a very regular stand. Immediately after chopping, 20 rows were selected and marked off into two sections 100 feet long. For each section a record was made of the number of hills, the number of skips over 2 feet long, the number of plants injured in chopping, and the number of surviving plants. At picking time the number of mature bolls on each section was counted.

As shown in Table 19, the number of mature bolls was found to be directly associated with the number of plants or of hills to the row. Where the number of plants or of hills is small, the number of bolls is usually low. The irregularity in the work of the individual choppers is also shown by the differences in the numbers of plants remaining and the numbers of skips in the row.[3]

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[2] The serial numbers (italic) in parentheses refer to "Literature cited," p. 47.

[3] These data were taken by Walter E. Clark, formerly assistant scientific aid, Office of Crop Acclimatization, Bureau of Plant Industry.

TABLE 19.—*Number of hills, skips over 2 feet long, injured plants, plants per 100-foot row, and bolls matured in each row of cotton in a chopped plot at Greenville, Tex.*

Row No.	Section 1					Section 2				
	Hills	Skips 2 feet long	Injured plants	Total plants	Matured bolls	Hills	Skips 2 feet long	Injured plants	Total plants	Matured bolls
1	82	7	0	133	244	70	6	2	104	199
2	59	14	2	80	194	80	9	6	135	233
3	81	8	1	132	232	78	8	3	115	191
4	64	16	2	82	199	97	5	17	179	246
5	56	16	6	91	213	62	8	0	74	171
6	75	9	2	95	244	74	6	7	169	261
7	76	5	3	94	225	78	6	6	114	200
8	54	13	2	72	196	84	6	8	145	227
9	79	6	2	160	269	63	11	4	80	172
10	79	6	6	120	246	81	7	3	145	193
11	83	5	17	123	260	74	5	1	119	187
12	62	9	2	99	217	73	11	7	131	215
13	75	8	4	106	255	69	6	3	98	181
14	71	11	0	95	194	84	8	38	193	270
15	83	3	6	158	267	64	11	8	99	178
16	61	14	2	103	188	74	7	5	165	258
17	94	2	8	177	318	77	8	3	97	155
18	54	14	1	75	193	93	3	4	183	245
19	73	5	3	145	273	53	13	5	80	167
20	69	10	1	104	228	63	15	1	84	201

RELATION OF SPACING TO FLOWER PRODUCTION

A greater production of flowers undoubtedly is one of the factors of increased yields in close spacings. The records of flowering were obtained by making daily counts of the flowers in rows of different spacings, beginning with the appearance of the first flowers and continuing until after the peak of flowering was passed. The production of flowers in the different spacings has usually shown the same general effects of seasonal influences. When more flowers were produced in one spacing, the same tendency appeared in other spacings.

A comparison of rows in which single plants were spaced 12 inches apart with spacings of less than this distance showed that more flowers were produced in the closer spacing until the peak of flowering was reached. The flower production usually declines more abruptly in the closer spacings than in the 12-inch spacing after the peak of production has been passed. The widest differences in flower counts were between the unthinned rows and the rows in which single plants were spaced 12 inches apart.

The rate of flower production in 1925 is shown graphically for four experiments in Figure 19, which includes four separate comparisons of different spacings. Single plants at 12 inches were used as the basis of the experiments, and the comparisons were made with two plants at 12 inches, three plants at 12 inches, plants blocked out in clumps, and with unthinned rows. The diagrams show the rate of flowering, with the records for the rows with single plants in broken lines and the rows of the closer spacings in solid lines. In each case the solid lines are above the broken lines until after the peak of flowering, when the solid lines fall below the broken lines. As boll weevils were not present in the 1925 comparisons, flower production continued in the wider spacings after the close spacings had practically ceased producing flowers.

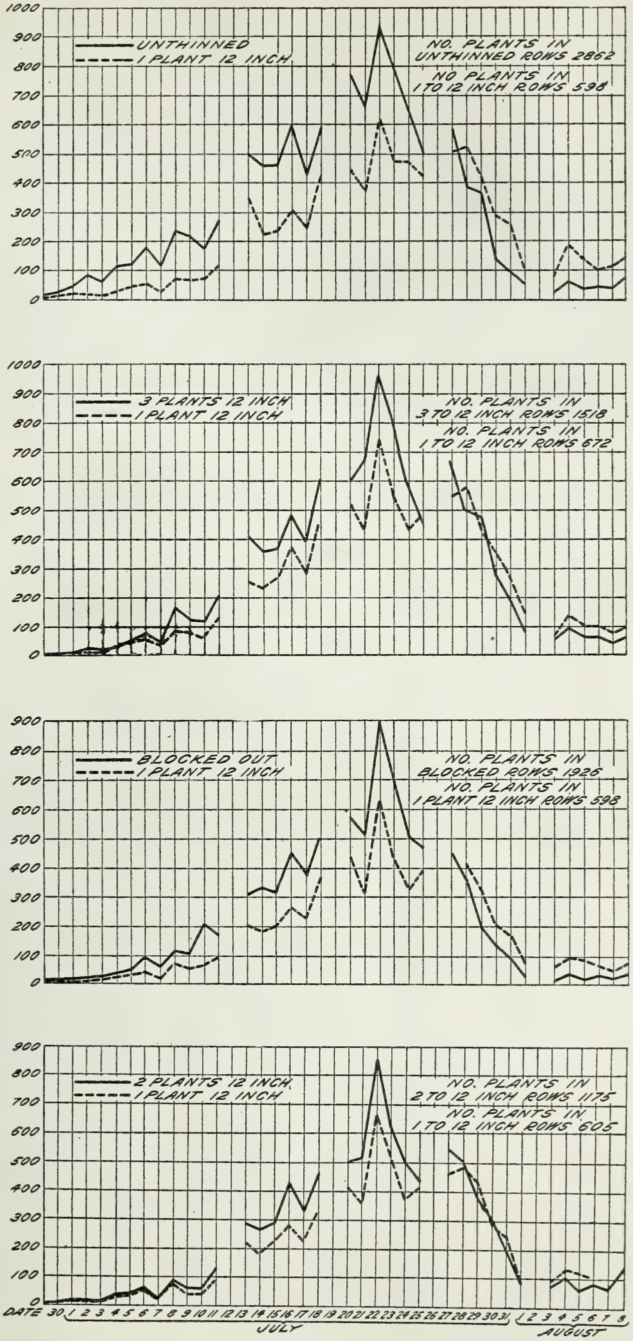

FIG. 19.—Daily flower production in cotton-spacing experiments at Greenville, Tex., 1925

Flower counts for different years have shown the same tendency toward the more determinate flowering in the closer spacings and to later flowering in the wider spacings, unless the flower buds were destroyed by the boll weevil. Although the rows with close-spaced plants produce more flowers daily, it is to be understood, of course, that fewer flowers per plant are produced than in the wider spacings.

RELATION OF SPACING TO BOLL AND LINT CHARACTERS

The length of lint does not appear to be affected by the distance between plants. Many determinations of length of lint from the different spacings were made during the years that these experiments were conducted, but no consistent differences were found. It appears that the close-spaced plants produced fiber of as good length and quality as that from wider spaced plants. These experiments, however, were conducted during very dry years in which the lint from all spacings was shorter than the variety would produce under more favorable conditions.

TABLE 20.—*Comparative boll and lint data from 10-boll samples of cotton from unthinned rows and rows with one plant every 12 inches, Greenville, Tex., 1925*

Spacing	Row Nos.	Weight (in grams) of— Seed cotton	Seed	Lint	Percentage of lint	Length of lint (inch)	Bolls per pound of— Seed cotton	Lint
Section 1:								
Unthinned	1-2	63.4	40.0	23.4	36.9	1	71.5	194
	3-4	59.9	36.9	23.0	38.4		75.7	197
One plant every 12 inches	1-2	60.6	37.7	22.9	37.8	1	74.8	198
	3-4	65.2	40.9	24.3	37.3		69.6	186
Unthinned	1-2	66.0	41.0	25.0	37.9	1	68.7	181
	3-4	61.0	39.0	22.0	36.0		74.3	206
One plant every 12 inches	1-2	60.7	38.5	22.2	36.6	1	74.7	204
	3-4	62.4	39.4	23.0	36.9		72.6	197
Unthinned	1-2	59.2	36.0	23.2	39.2	1	76.6	195
	3-4	56.8	34.5	22.3	39.3		79.8	203
One plant every 12 inches	1-2	56.5	34.9	21.6	38.2	1	80.3	210
	3-4	63.7	37.2	26.5	41.6		71.2	171
Section 2:								
Unthinned	1-2	60.1	37.9	22.2	36.9	1	75.5	204
	3-4	61.6	39.7	21.9	35.5		73.6	207
One plant every 12 inches	1-2	59.0	37.6	21.4	36.3	1	76.9	212
	3-4	60.0	36.3	23.7	39.5		75.6	191
Unthinned	1-2	54.3	33.0	21.3	39.2	1	83.5	213
	3-4	53.0	32.4	20.6	38.9		85.6	220
One plant every 12 inches	1-2	49.1	30.2	18.9	38.5	$\frac{15}{16}$	92.4	240
	3-4	54.8	33.6	21.2	38.7		82.8	214
Unthinned	1-2	52.3	30.7	21.6	41.3	$\frac{15}{16}$	86.7	210
	3-4	54.1	31.5	22.6	41.8		83.9	200
One plant every 12 inches	1-2	55.2	32.5	22.7	41.1	1	82.2	200
	3-4	54.9	32.6	22.3	40.6		82.6	203
Section 3:								
Unthinned	1-2	53.3	31.5	21.8	40.9	1	85.1	208
	3-4	54.8	31.3	23.5	42.9		82.8	193
One plant every 12 inches	1-2	51.2	30.8	20.4	39.9	1	88.6	222
	3-4	60.4	36.2	24.2	40.1		75.1	187
Unthinned	1-2	55.2	31.9	23.3	42.2	1	82.2	194
	3-4	57.2	34.2	22.9	40.0		79.3	198
One plant every 12 inches	1-2	58.5	35.5	23.0	39.3	1	77.5	197
	3-4	53.4	31.7	21.7	40.6		85.0	209
Unthinned	1-2	49.1	28.5	20.6	41.9	$\frac{15}{16}$	92.4	220
	3-4	50.4	29.0	21.4	42.5		90.0	212
One plant every 12 inches	1-2	59.2	35.2	24.0	40.5	1	76.6	189
	3-4	62.0	37.5	24.5	39.5		73.2	185

Both Cardon (*1*) and Meade (*8*), in reporting upon experiments with plants spaced at different distances in the row, show that the percentage of lint is not reduced by close spacing. In the experiments at Greenville there has been no indication of a reduction in the percentage of lint from closely spaced plants. On the contrary, there seems to be a tendency toward a higher percentage of lint from the rows left unthinned than from wider spacings. Boll and lint data compiled from 10-boll samples, taken from the 1925 comparison of one plant every 12 inches with unthinned rows, are shown in Table 20.

Table 20 shows little variation in length of lint from the two spacings, but there is considerable fluctuation in the weight of the individual 10-boll samples and also in percentage of lint. This variation in boll weight and percentage of lint emphasizes the importance of using a considerable number of samples for laboratory examination. Table 20 shows that the percentage of lint from both spacings was higher in section 3 than in section 1. The data presented in Table 20 are summarized in Table 21, where each number represents a mean of 18 cases.

TABLE 21.—*Summary of data in Table 20, each number representing the mean of the 18 cases mentioned therein*

Spacing	Weight (in grams) of—			Percentage of lint	Length of lint (inch)	Bolls per pound of—	
	Seed cotton	Seed	Lint			Seed cotton	Lint
Unthinned	56. 7	34. 4	22. 3	39. 5	1	80. 4	203
One plant every 12 inches	58. 1	35. 4	22. 7	39. 0	1	78. 7	201

The size of boll is an important plant character that appears to be affected by leaving plants close together in the row. There is usually a reduction in boll size in the closely spaced plants. Sometimes the difference is very slight and again it is very pronounced.

In the experiments conducted in 1923 and 1924 the unthinned rows required more bolls to produce a pound of seed cotton than the wider spacings. The mean number of bolls required to produce a pound of seed cotton from the different spacings in six different experiments in 1923 was as follows: Unthinned, 80; 6 inch, 80; 12 inch, 71; chopped, 65; hills (1 plant), 70; hills (several stalks), 80; and thinned by cross cultivation, 71.

In the 1924 experiments there was very little difference in the boll size from the different spacings. The mean number of bolls per pound of seed cotton in the experiment on fine sandy loam soil at Campbell, was 66.6 for the chopped rows and 69.4 for the unthinned rows. In the experiment made at Greenville, on the Houston clay soil, the mean number of bolls per pound of seed cotton was 85.4 for the unthinned rows and 83.7 for the thinned. In 1925 the boll size from the closer spacings was only slightly reduced, as shown in Table 20.

A slight reduction in boll size and a small increase in percentage of lint appears to be associated with close spacing. The seed weight is usually less from the smaller bolls and is responsible for the higher percentage of lint.

RELATION OF SPACING TO WEEVIL RESISTANCE

Plants that are left close together in the rows are reduced in size, principally through the suppression of vegetative limbs which arise from near the base of the main stalk (*2*). With vegetative growth restricted, more plants can be added to the row without injurious crowding, and a larger crop of bolls can be set early in the season.

Reducing the size of the plants is very important under boll-weevil infestation, as more sunlight is admitted to the row lanes throughout the day and the air allowed to circulate more freely through the field. With small plants and open lanes, the infested squares or young bolls that are shed fall on open sunlit earth which soon dries them out and either kills or greatly retards development of the immature weevils; but, with large plants and heavily shaded lanes, the conditions are much more favorable to weevil development. The mortality of immature weevils under the intense heat of the sun on the hot earth of a row lane without shade is undoubtedly much higher than under more humid and shady conditions obtained in rows with wider spaced and more luxuriant plants.

Hunter and Pierce (*6*) report the mortality of weevils at immature stages from heat and dryness as averaging 23.8 per cent for given dates from May to October. Smith (*9*) adds that, if counts were extended over the entire period from egg to adult, this figure might be trebled. The same writer submits evidence to show that the mortality of the immature weevils will run as high as 91.3 per cent under hot, dry conditions in Florida. This figure might often be exceeded in the drier districts of Texas.

Since heat and dryness play so important a part in the control of the boll weevil, a very practicable and economical contribution toward control is put into operation by restricting the growth of the cotton plant and allowing an abundance of sunlight to fall in the row lanes throughout the day. Also, the more compact rows with closely spaced plants can be much more effectively and efficiently poisoned with improved dusting machinery than can the larger branching type of plants.

Early maturity is another important factor under weevil conditions. By suppressing the lower limbs, which do not directly produce bolls, early maturity of the crop is favored. The fact that successive fruiting branches are formed in about one-third of the time that successive squares appear on fruiting branches accounts for more rapid fruiting in a vertical series along the axis of the plant than in a horizontal series along the fruiting branch (*7*). An early crop of cotton is produced largely from bolls at the first nodes of the primary fruiting branches, not on the limbs or vegetative branches. In fact, it is not possible to produce an early crop of cotton on large, luxuriant plants.

CONCLUSIONS

The spacing experiments discussed in this report extend over a period of five years, from 1921 to 1925, inclusive, and include many repetitions. The combined results show larger yields from the closer spacings and indicate that cotton plants generally are left in the fields at distances too far apart to obtain the best yields. The five summers during the progress of the experiments reported herein were dry to extremely dry, and it is recognized that under more humid conditions the behavior of the spacings might be somewhat different.

Close spacing reduces the size of the plant and allows a greater number of stalks to be left in the row without injurious crowding. The fruiting branches on closely spaced plants are short, and the crop is produced on the first few nodes of the branches. Since the cotton plant fruits more rapidly vertically along the axis of the plant than horizontally along the fruiting branches, the setting of early bolls is promoted by leaving the plants close together.

Percentage of lint and length of lint are apparently not affected by close spacing, but the size of the bolls is slightly reduced.

The yields from the unthinned rows, where the plants averaged from 2 to 4 inches apart, and from the 6-inch spacings were usually greater than from the rows where the plants were spaced 12 inches apart. In a few cases the wider spacings gave a higher total yield, but the increase was significant in only one experiment.

The yield of the 6-inch spacing is generally higher than that of the 12-inch spacing. The 6-inch spacing tends to approximate the yield of the unthinned rows and is sometimes greater. This indicates that better yields are obtained on the black land when the plants are spaced less than 12 inches apart in the row.

Several stalks to the hill produced more cotton than one stalk to the hill where the hills were more than 12 inches apart.

Chopped rows compared with unthinned rows indicate that the yield is more likely to be reduced than increased by chopping.

There appear to be chances for greater increase in yields from closely spaced plants where grown on light soils, than on heavy soils, as the experiments on fine sandy loam showed more outstanding differences in favor of the unthinned rows.

Closely spaced plants produce few vegetative branches, so that the lanes between the rows are left open and exposed to direct sunlight during the summer. The heat of the sun in the open row lane rapidly dries out the squares containing the boll-weevil larvæ and materially reduces their number. By leaving the plants closely spaced in the rows, a practical and economical contribution toward weevil control is put into operation.

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